

FINAL REPORT

SKYHOOK 1966

CONTRACT N00014-67-C-0157

for

OFFICE OF NAVAL RESEARCH

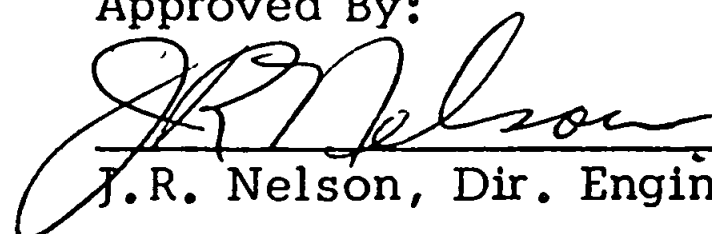
WASHINGTON 25, D.C.


REPORT NO. 1289-R

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I. ABSTRACT

Office of Naval Research Contract N00014-67-C-0157 was awarded to Winzen Research Inc. to conduct a series of three flights from Fleming Field, South St. Paul, Minnesota for Dr. James Earl, University of Maryland and three flights from International Falls, Minnesota for Dr. Donald Hagge, Goddard Space Flight Center, NASA following the main Skyhook 1966 program at Fort Churchill, Canada. The latter three flights were subsequently moved to a launch site at Bemidji, Minnesota.

Winzen Research Inc. provided personnel, facilities, balloons and flight equipment as follows to conduct this program.

1. Balloons and flight control instrumentation.
2. Launching, tracking and recovery operations.
3. Rigging of payloads and coordination with scientific investigators.
4. Operations reports.

This report expands the preliminary data submitted after each flight and constitutes the final report for this program.

## II. INTRODUCTION

The 1966 Fall Skyhook Program anticipated a series of three flights from the Minneapolis area for Dr. Earl and a series, not to exceed four flights, from International Falls, Minnesota for Dr. Hagge to be conducted during August and September 1966. \*

A total of seven flights were made between 27 August and 23 September 1966, of which six flights were successful and one flight was prematurely terminated just before reaching float altitude.

The flight crew and equipment were sent to International Falls to conduct the flights, but were delayed awaiting clearance for possible Canadian overflights. After one week the crew returned to Minneapolis for a week, and the equipment then moved to Bemidji, Minnesota, from where the flights were launched.

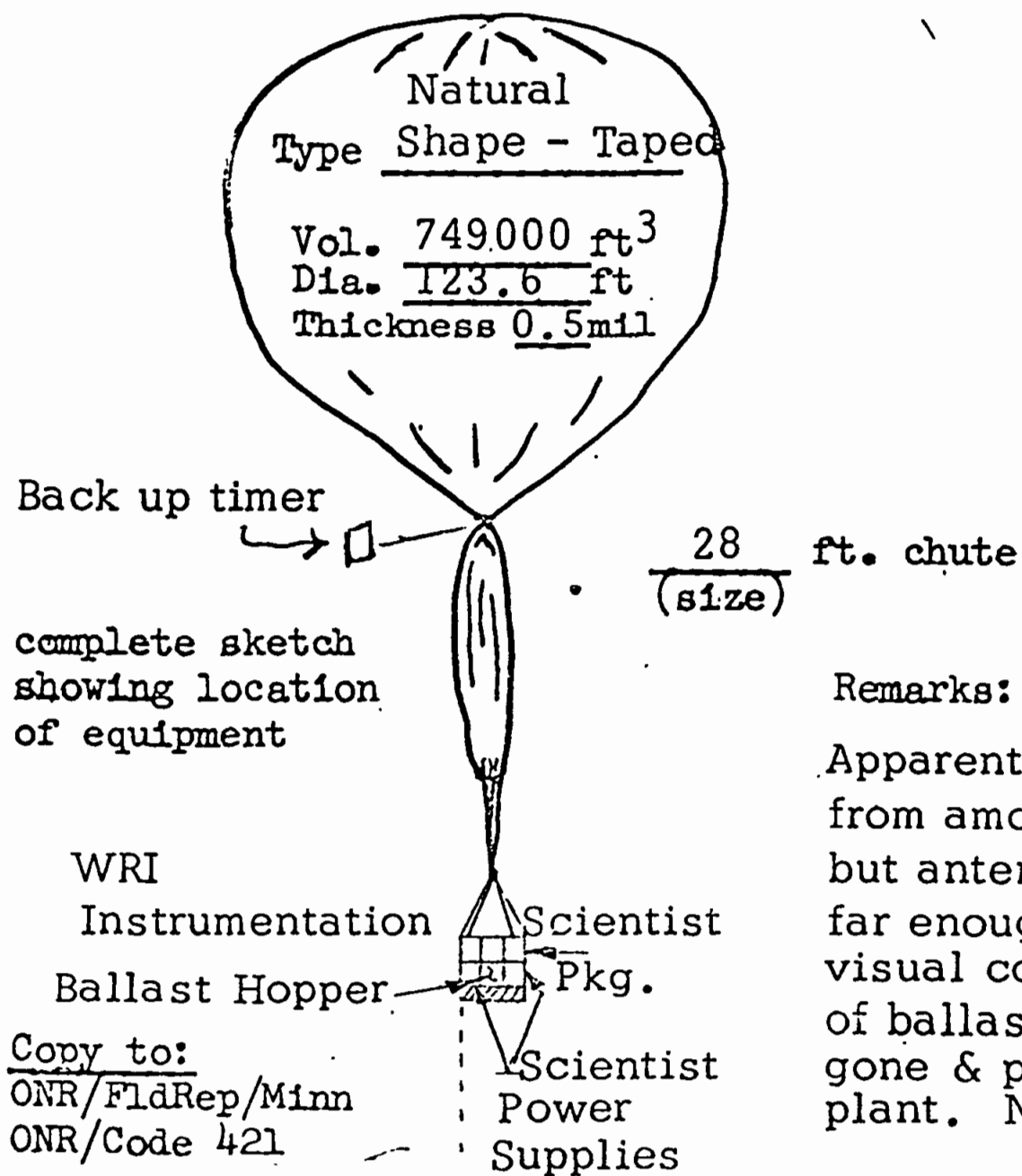
The original proposal contemplated two flights with a possibility of a third. This was subsequently changed to four flights.

### III. RESULTS OF FLIGHT OPERATIONS

The following pages cover individual reports for each of the seven flights conducted during this operation.

SKYHOOK BALLOON FLIGHT INFORMATION  
 NAVEXOS 3900/2 (Rev.11-63)

1. Company Winzen Research Inc. Flight number 1056-W
2. Scientist Dr. James Earl Organization University of Maryland
3. Launch: Site Fleming Fld., S. St. Paul Date/time 27 August 1966 1200Z  
 Technique Split Launch Arm Director O.C. Winzen, L. Mielke
4. Weather: Clear, 69°F - Calm Tropopause: Height 48,000' Temp -65 °C  
 ( Sky - Temp - Wind - Press )
5. Balloon Ceiling: Theoretical 6.62 Mbs 111,600 Ft. Actual: 113,000 Ft. 6.22 Mbs  
 How altitude determined Scientist's telemetry
6. Ascent: Surface to tropopause 385 fpm. Tropopause to ceiling 496 fpm.
7. Flight duration: Total 10 hrs. 25 min. At ceiling 5 hrs. 40 min.
8. Termination: Time 2145 Z Altitude 104,500 ft. Cause Command from plant
9. Balloon destruction - confirmed Visual by 206 pilot - McFall  
 (visual - unknown - etc.)
10. Impact: Date/time 27 August 66 2225 Z Location 1 mile E. Modena, Wisconsin
11. Frequency used: (Kcs, Mcs) (purpose) (Total Time) Standby/  
 1724 Kcs Barotransmitter - Radiating  
 138.540 Mcs Command 10:25/00:10  
 138.840 Mcs Communications 10:25/00:30
12. Balloon: Code number SF 123.6-050-NS-01 Serial number 2



	WEIGHT
Balloon - - - - -	160 #
FAA Termination Timer	3
Parachute - - - - -	12
Instrumentation - - -	42
Ballast - - - - -	122
Scientific package - -	115
Other gondola & hopper	43
Gross Weight - - - - -	497 #
Free Lift - - - - -	31
Gross Inflation - - -	528
Helium used - - - - -	8000 ft <sup>3</sup>

Remarks: Smooth launch under calm conditions. Apparently low free lift in balloon - estimated at 10 lbs. from amount of anchor line lifted. Antenna squib fired but antenna not dropped. Did not drop far enough to shear restraining tape - no beacon, but visual contact thruout flight maintained. No verification of ballast drops during flight. Post flight showed ballast gone & patch blown. Termination by command from WRI plant. No recovery problems.

1. Launch Operation (Fleming Field, South St. Paul, Minnesota)

Ground winds were calm and a smooth launch was effected. The helium injected into the balloon was metered by observing the initial and final temperatures and pressures of the inflation tank. It was attempted to inject sufficient helium to achieve an ascent rate of 700 fpm. The free lift used was 6.3% and was calculated using University of Minnesota formula.\* An attempt was made to deploy the antenna at approximately 500 foot altitude. However, the antenna did not deploy. Upon recovery it was determined that this was due to an error in rigging.

2. Tracking

Since the antenna did not deploy it was impossible to receive altitude data and ADF transmissions from the RBA-7B transmitter used for this flight. However, the sky was clear and visual contact was maintained throughout the flight both by plane and by the ground tracking vehicle.

3. Recovery

Termination and balloon destruction were witnessed both by plane and ground tracking vehicle. Severe oscillation of the parachute and payload was observed at high altitude. The airplane maintained visual contact during descent and guided the ground vehicle to the impact point. The load landed in a wooded area one mile east of Modina, Wisconsin. The chute hung up in several trees and the load was suspended about one foot above the ground when the ground crew arrived at the load. No external damage to the instrumentation or its supporting framework was observed. Dr. Earl's equipment was returned to WRI plant at 2400 CDT, 27 August 1967.

4. Balloon Performance

When the balloon had climbed to about 1000' altitude it was noted that its ascent rate was under 500 fpm. This low rate was due to a lack of free lift which was probably caused by inaccuracies in the metered system of balloon inflation. To increase the rate the flight director attempted to drop ballast. No verification was received and the ascent rate did not noticeably increase. Additional ballasting attempts indicated the ballast system was not functioning properly. Post flight check of the ballast system showed it to be mechanically sound but it was determined that the ballast system would not function when its power supply voltage fell below 19 V. Although

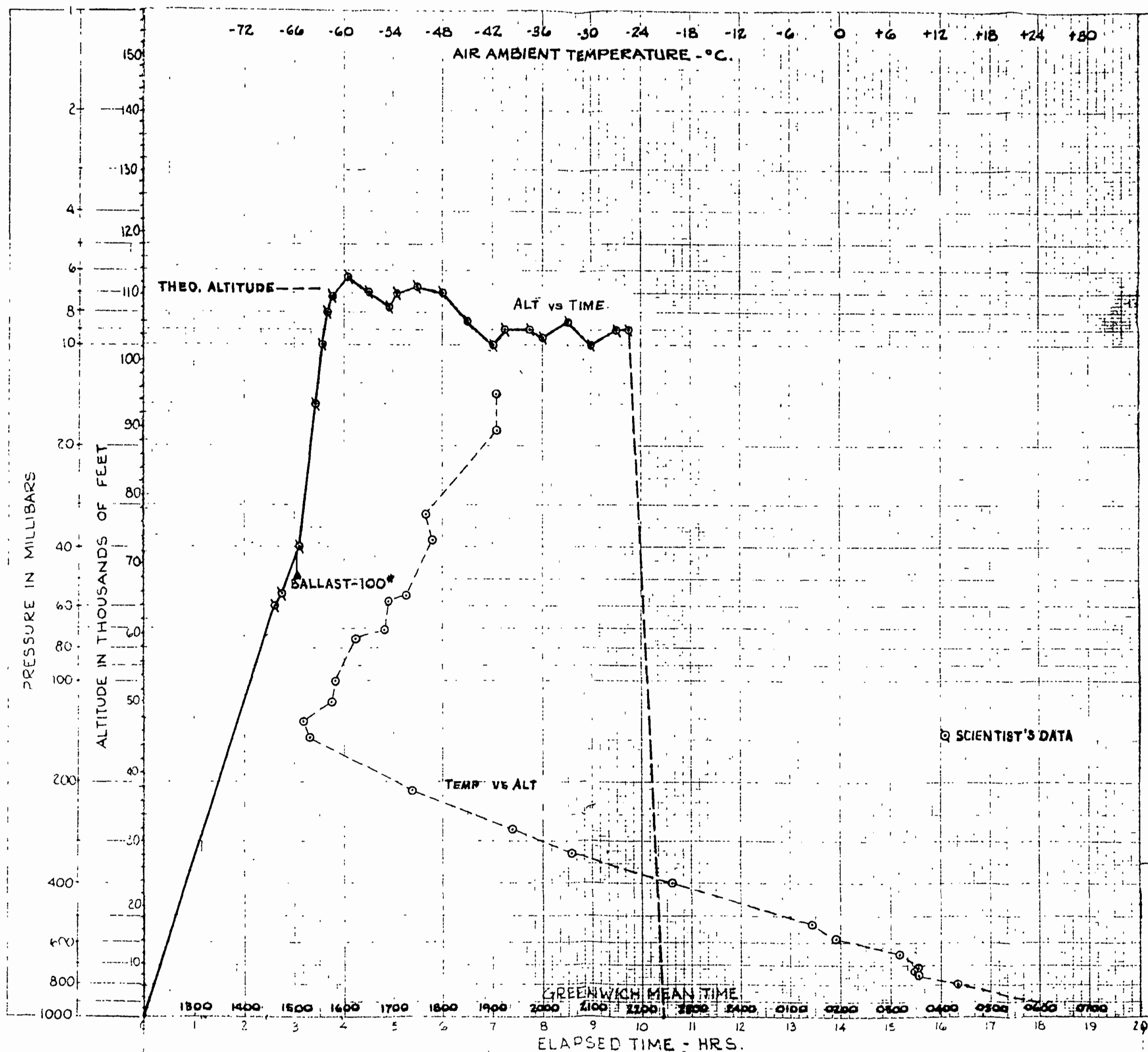
\* Progress Report on High Altitude Plastic Balloons, Contract Nonr 710(01)  
June 15, 1952 to December 22, 1952, Vol. V, P. VI 204

## Flight 1056-W

it is doubtful that the power supply voltage was this low (24 V nominal) at the beginning of the flight the ballast system has been modified to perform satisfactorily at 14 volts minimum. The actual rate of ascent was calculated to be 413 fpm from launch to 64,000 feet as determined from Dr. Earl's altitude measuring instrumentation. At 72,000 feet a patch was blown out of the bottom of the ballast hopper by radio command. The rate of rise increased to 1000 fpm and remained constant until just prior to ceiling where it decreased.

The flight profile at altitude oscillated somewhat with a general downward trend of 24 fpm (beginning at a maximum altitude of 113,000 feet). The flight was terminated by radio command from the WRI plant due to a cloud bank moving into the recovery area which would have eliminated visual contact between the balloon and tracking personnel.





**FLIGHT NO 1056-W**

**FOR: UNIVERSITY OF  
MARYLAND -  
DR. JAMES EARL**

**GENERAL INFORMATION:**

DATE - 27 AUG 1966  
LOCATION - FLEMING FIELD  
LAUNCH TIME - 1700 Z  
REACH FLOAT - 1605 Z  
TERMINATION - 2145 Z  
FLOAT TIME - 5 HRS. 40 MIN.  
IMPACT TIME - 2225 Z  
IMPACT LOC'N - 1 MILE. MODENA,  
WISC.

**BALLOON DATA**

MODEL NO. - SF-123.6-050-N9-01  
VOLUME - 749,000 CU. FT.  
MATERIAL - 0.5 MIL STRATOFILM  
LOAD TAPE - 100 LB. STRATOTAPE  
WEIGHT - 160 LBS.

**FLIGHT DATA:**

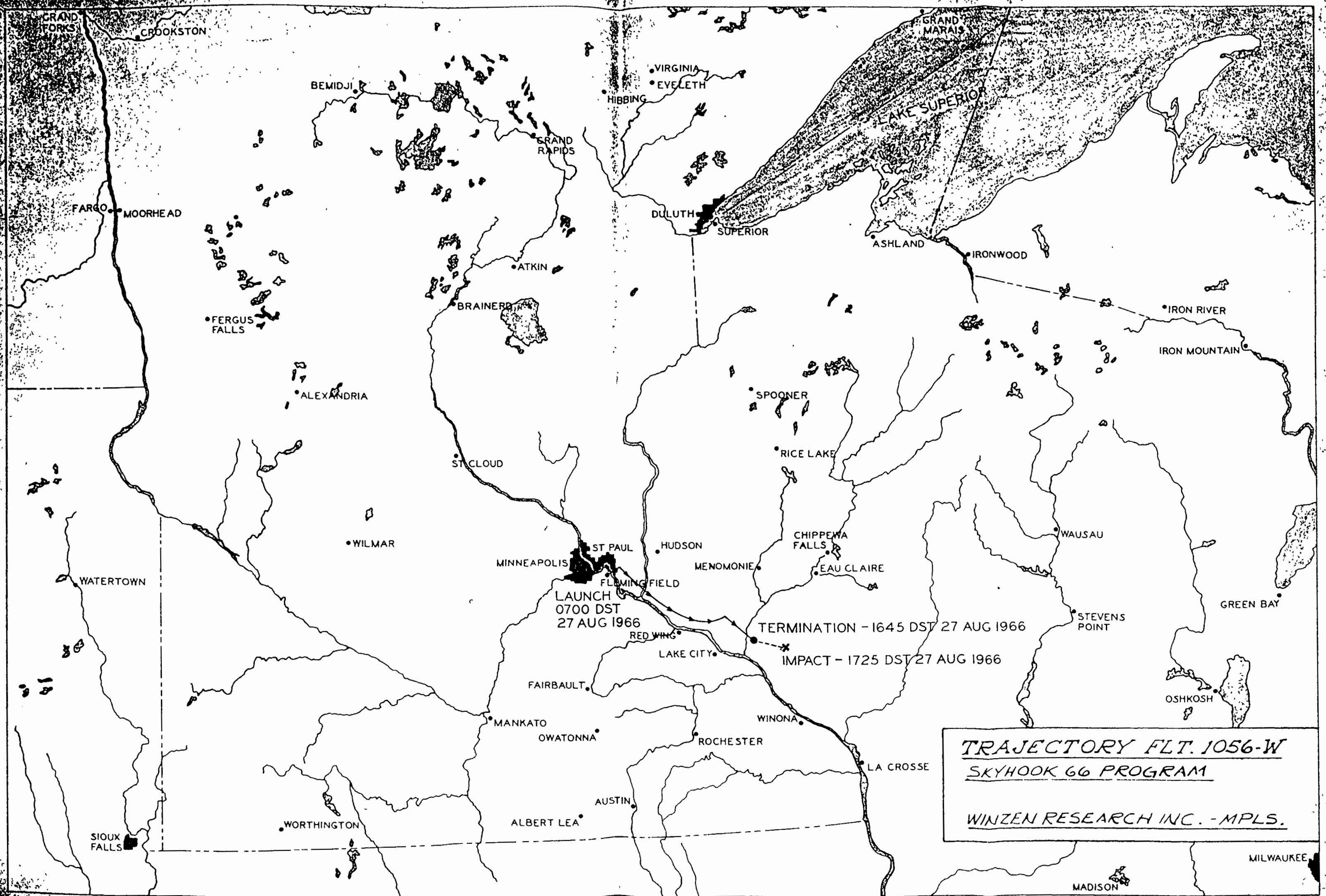
PAYLOAD - 215 LBS.  
GROSS LOAD - 497 LBS.  
FREE LIFT - 31 LBS  
BALLAST - 122 LBS.

**COMMENTS:**

SMOOTH LAUNCH. ANTENNA DID  
NOT DEPLOY. VISUAL CONTACT  
THROUGHOUT FLIGHT. METERED  
BALLAST SYSTEM INOPERATIVE  
RECOVERED AND RETURNED TO  
SCIENTIST 2400CDT 27 AUG.



**WINZEN RESEARCH INC  
MINNEAPOLIS, MINNESOTA**



*TRAJECTORY FLT. 1056-W*  
*SKYHOOK 66 PROGRAM*  
*WINZEN RESEARCH INC. - MPLS.*

SKYHOOK BALLOON FLIGHT INFORMATION  
NAVEXOS 3900/2 (Rev.11-63)

1. Company Winzen Research Inc. Flight number 1057W

2. Scientist Dr. James Earl Organization University of Maryland

3. Launch: Site Fleming Field, S. St. Paul Date/time 30 August 1967 0021Z  
Technique Split Launch Arm Director S.K. Swenson, L. Mielke

4. Weather: Clear 89°F Calm Tropopause: Height 51,000 Temp -62°C  
( Sky - Temp - Wind - Press )

5. Balloon Ceiling: Theoretical 8.5 Mbs 106,000 Ft. Actual: 101-110 K Ft. 7.1-10 Mbs  
How altitude determined WRI RBA-7B Barotransmitter

6. Ascent: Surface to tropopause 958 fpm. Tropopause to ceiling 711 fpm.

7. Flight duration: Total 23 hrs. 55 min. At ceiling 21 hrs. 06 min.

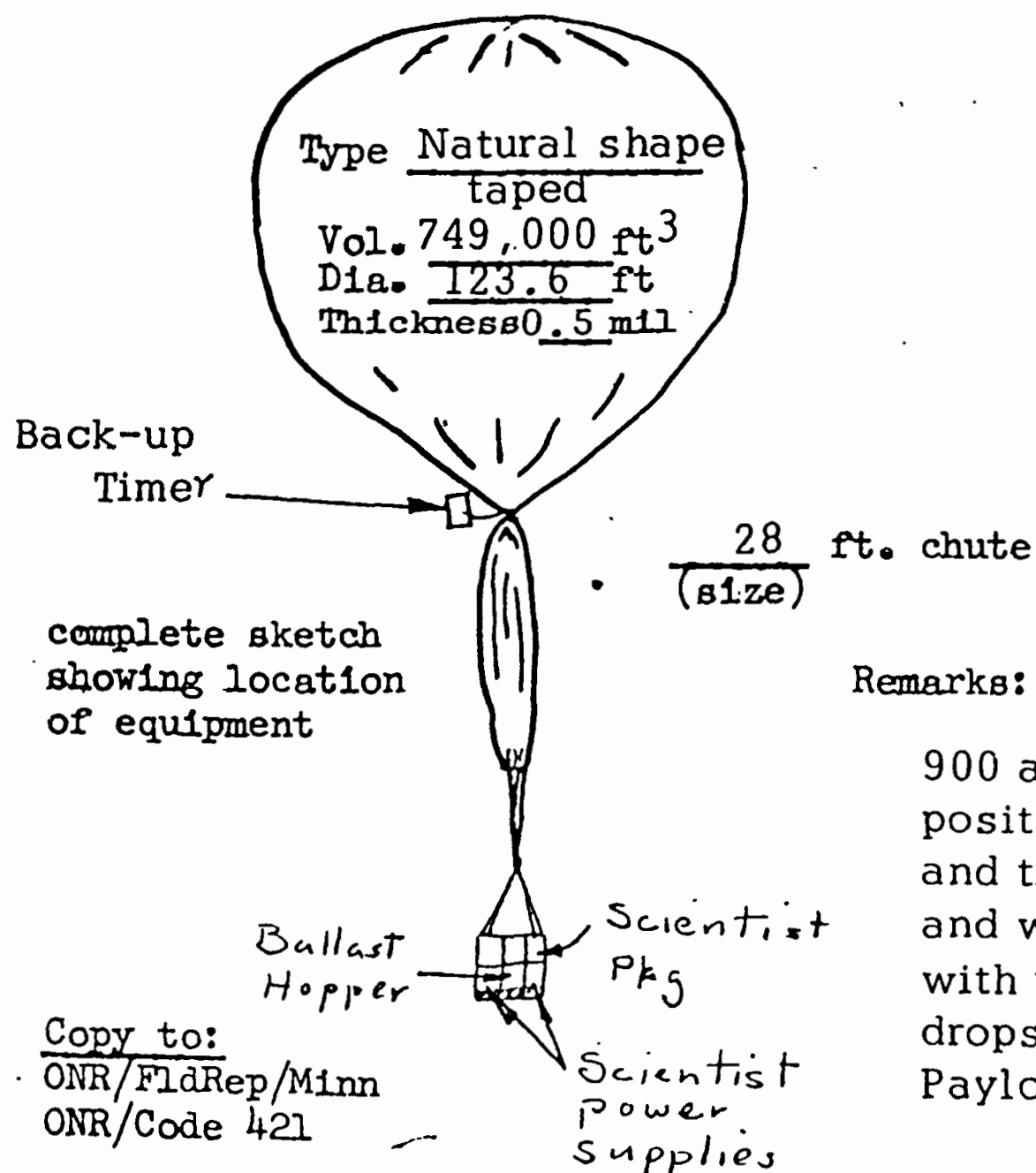
8. Termination: Time 2338 Z Altitude 7.6 mb -108.5 Kft. Cause Radio command

9. Balloon destruction - confirmed Burst - visual by 206 Pilot McFall  
(visual - unknown - etc.)

10. Impact: Date/time 31 August 1966 0016 Z Location 1-1/2 miles NW of Benson  
Minnesota

11. Frequency used: (Kcs, Mcs) (purpose) (Total Time) Standby/  
1724 Barotransmitter 14:00/14:00 Radiating  
138.84 Voice 23:55/00:30  
138.54 Command 23:55/00:10

12. Balloon: Code number SF 123.6-050-NS-01 Serial number 4



	WEIGHT
Balloon - - - - -	153 #
FAA Termination Timer	3
Parachute - - - - -	12
Instrumentation & gondola	105
Ballast - - - - -	120
Scientific package - -	115
Other - - - - -	
Gross Weight - - - - -	508 #
Free Lift 14.57% - - -	74
Gross Inflation - - - -	582
Helium used - - - - -	8818 cuft.

Remarks: Smooth Launch. Avg. rate of rise between 900 and 1000 fpm to almost 90,000 feet. Balloon position determined by ADF from two positions, plant and truck. Beacon signal erratic during early A.M. and went out completely at 0930. Flight continued with visual contact to termination. Several ballast drops made during day from plant as was termination. Payload returned 8-31-66.

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ONR/Code 421

## FLIGHT 1057-W

### 1. Launch Operations (Fleming Field, South St. Paul, Minnesota)

Balloon was launched at 1921 CDT, 29 August 1966. The sky was clear and surface winds from the Northwest at 3 mph. A smooth launch was effected. Layout to launch took 1 hour and 10 minutes. The beacon antenna was deployed smoothly by radio command at approximately 500 feet.

### 2. Tracking

Tracking was accomplished with a ground tracking vehicle, airplane, WRI instrumentation at WRI plant and Dr. James Earl's telemetry equipment stationed at WRI plant. Initially the flight beacon performed normally. After about 12 hours of flight the beacon transmissions became intermittent and finally ceased two hours later. However, by this time (0930 CDT, 30 August) visual contact had been established by ground vehicle, airplane and a theodolite at the WRI plant. The balloon floated west, out of theodolite range but contact was maintained by ground vehicle and airplane. At 1700 CDT broken cloud cover moved into the flight area. The flight was terminated by radio command from the WRI plant at 1838 CDT. Termination and balloon destruction were witnessed by airplane crew who guided the ground crew to the impact location.

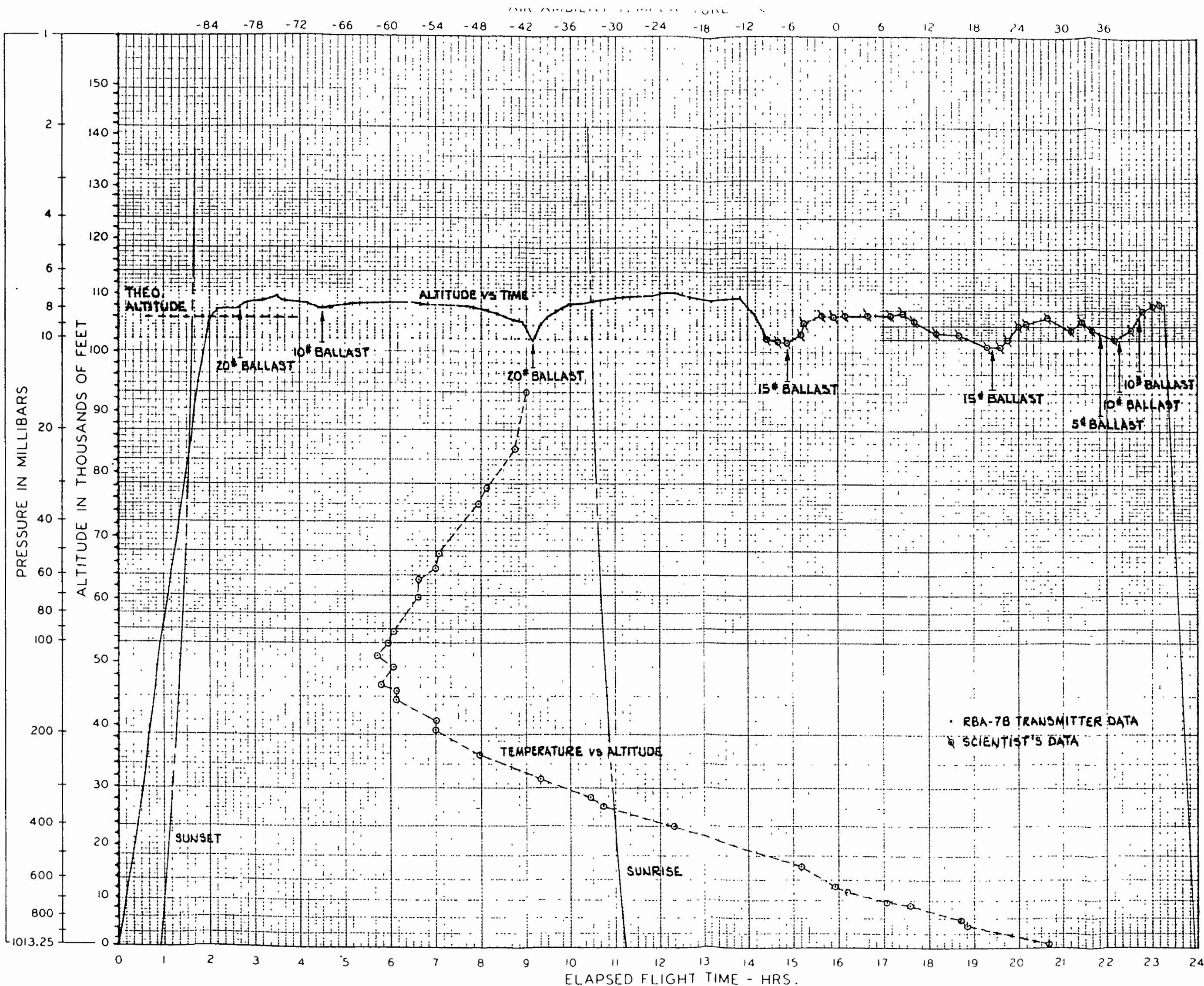
### 3. Recovery

Load landed in farmers field 1-1/2 miles N.W. of Benson, Minnesota. Instrumentation appeared undamaged by impact but load framework was badly bent. Power supply was returned by plane to scientist at 2200 CDT, 30 August and remaining scientific instrumentation arrived by truck 1230 CDT, 31 August.

### 4. Balloon Performance

The average rate of ascent from launch to 105,600 feet was 850 fpm.. Balloon altitude throughout the flight was maintained by ballast drops. All commands functioned well and were initiated at the WRI plant. The ceiling altitude varied from 101,000 feet to 110,300 feet. The theoretical altitude for this load including all ballast was 106,100 feet. Inspection of beacon after return to WRI plant showed the flexible spring coupling between motor and code drum to be broken. Consequently a flexible bellows type coupling has been tested for a period of one week and has been subjected to cyclic temperature variations as would have been experienced at altitude during an extended flight. Its performance has been excellent and therefore it has been decided to replace the flexible spring coupling with the flexible bellows coupling.





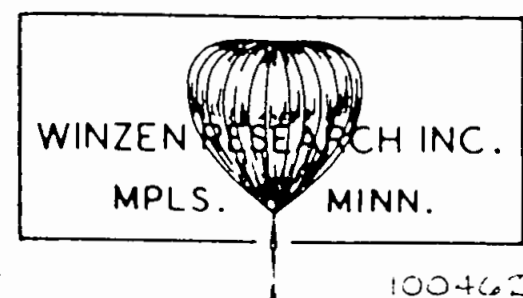
FLIGHT NO 1057-W  
 FOR:  
 UNIVERSITY OF MARYLAND -  
 DR. JAMES EARL

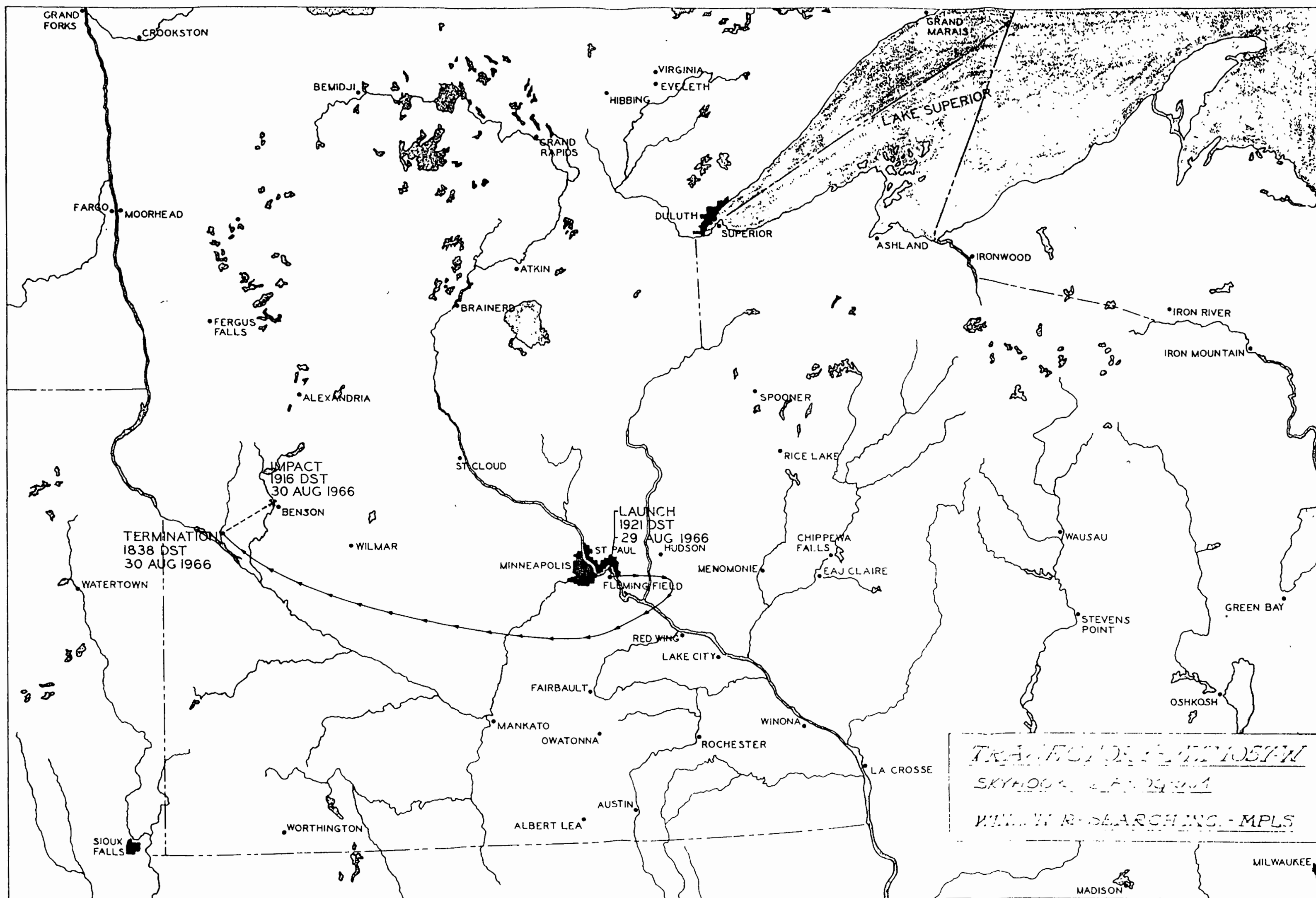
GENERAL INFORMATION:  
 DATE - 30 AUGUST 1966  
 LAUNCH LOCATION -  
 FLEMING FIELD -  
 SO. ST. PAUL, MINN.  
 LAUNCH TIME - 0021 Z  
 REACH FLOAT - 0232 Z  
 FLOAT DURATION - 21 HRS. 06 MIN.  
 TERMINATION - 2338 Z  
 IMPACT TIME - 31 AUG 1966 - 0016 Z  
 IMPACT LOCATION -  
 1 1/2 MI. N.W. OF BENSON, MINN.

BALLOON DATA:  
 MODEL NO SF-123.6-050-N5-01  
 SERIAL NO - 04  
 VOLUME - 749,000 CUBIC FEET  
 MATERIAL - 0.5 MIL STRATOFILM  
 LOAD TAPES - 100 LB. STRATOTAPE  
 WEIGHT - 153 LBS.

FLIGHT DATA:  
 PAYLOAD WT - 235 LBS.  
 GROSS LOAD - 508 LBS.  
 FREE LIFT - 74 LBS.  
 BALLAST WT - 120 LBS.

REMARKS:  
 SMOOTH LAUNCH. BEACON TRANS-  
 MISSIONS CEASED MIDWAY IN FLT.  
 ALTITUDE MAINTAINED BY 8 BALLAST  
 DROPS DURING FLT. LOAD LANDED IN  
 SMOOTH FIELD.





SKYHOOK BALLOON FLIGHT INFORMATION  
NAVEXOS 3900/2 (Rev.11-63)

1. Company Winzen Research Inc. Flight number 1058W

2. Scientist Dr. James Earl Organization University of Maryland

3. Launch: Site Fleming Field, S. St. Paul Date/time 7 Sept. 1966 0002Z

Technique Split Launch Arm Director Soren Swenson

4. Weather: Clear 72° Calm Tropopause: Height 39,000 Temp -61 °C  
( Sky - Temp - Wind - Press )

5. Balloon Ceiling: Theoretical 8.53 Mbs 105,900 Ft. Actual: 107,600 Ft. 7.91 Mbs  
How altitude determined WRI Barotransmitter RBA-7B

6. Ascent: Surface to tropopause 775 fpm. Tropopause to ceiling 656 fpm.

7. Flight duration: Total 23 hrs. 33 min. At ceiling 20 hrs. 25 min.

8. Termination: Time 2300 Z Altitude 106,900 ft. Cause Radio Command

9. Balloon destruction - confirmed Visual by tracking plane and ground vehicle  
(visual - unknown - etc.)

10. Impact: Date/time 7 Sept. 1966 2335 Z Location 1/2 mile East, Cable, Wisconsin

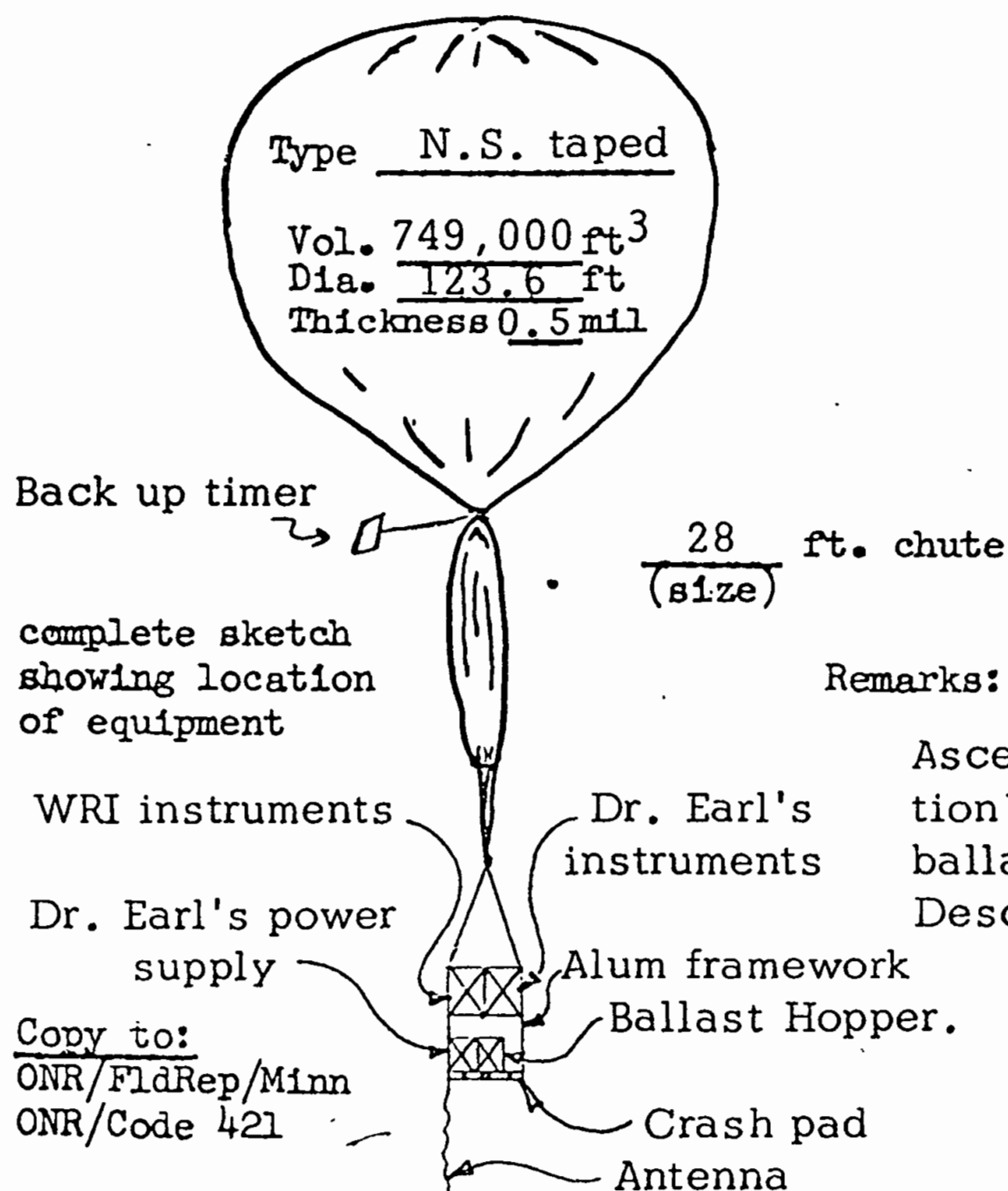
11. Frequency used: (Kcs, Mcs) (purpose) (Total Time)

<u>1724 Kc</u>	<u>Alt. and ADF</u>	<u>23:33/23:33</u>
<u>138.840 Mc</u>	<u>Voice</u>	<u>23:33/01:00</u>
<u>138.540 Mc</u>	<u>Command</u>	<u>23:33/00:10</u>

12. Balloon: Code number SF 123.6-050-NS-01 Serial number 6

WEIGHT

Balloon - - - - -	<u>162 #</u>
FAA Termination Timer	<u>1</u>
Parachute - - - - -	<u>12</u>
Instrumentation - - -	<u>62</u>
Ballast - - - - -	<u>120</u>
Scientific package - -	<u>135</u>
Other framework & crash pads	<u>40</u>
Gross Weight - - - - -	<u>532</u>
Free Lift - - - - -	<u>80</u>
Gross Inflation - - -	<u>612 lbs.</u>
Helium used - - - - -	<u>9275 cuft.</u>



Remarks:

Launch was made with zero surface wind. Ascent rate to ceiling was 694 fpm. All instrumentation functioned satisfactorily. Level flight without ballast. 106,700 ± 900' for 20 hrs. 25 min. Descent tracked visually to ground by plane and truck. Payload landed on gravel road in heavily wooded area.

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## FLIGHT 1058 W

### 1. Launch Operation (Fleming Field, South St. Paul, Minnesota)

Surface winds were completely calm at time of launch. During launch the balloon picked the payload off load cart and as it did the payload hit the ground. The impact was not large as it was not sufficient to damage the crash pad on which it hit. The antenna deployed smoothly by radio command at about 500 feet.

### 2. Tracking

Altitude data and ADF transmissions were excellent throughout the flight. The airplane and ground vehicle tracking crews made visual contact with the balloon shortly after sunrise and maintained contact until impact. The winds at altitude were variable as the balloon path continued to change direction.

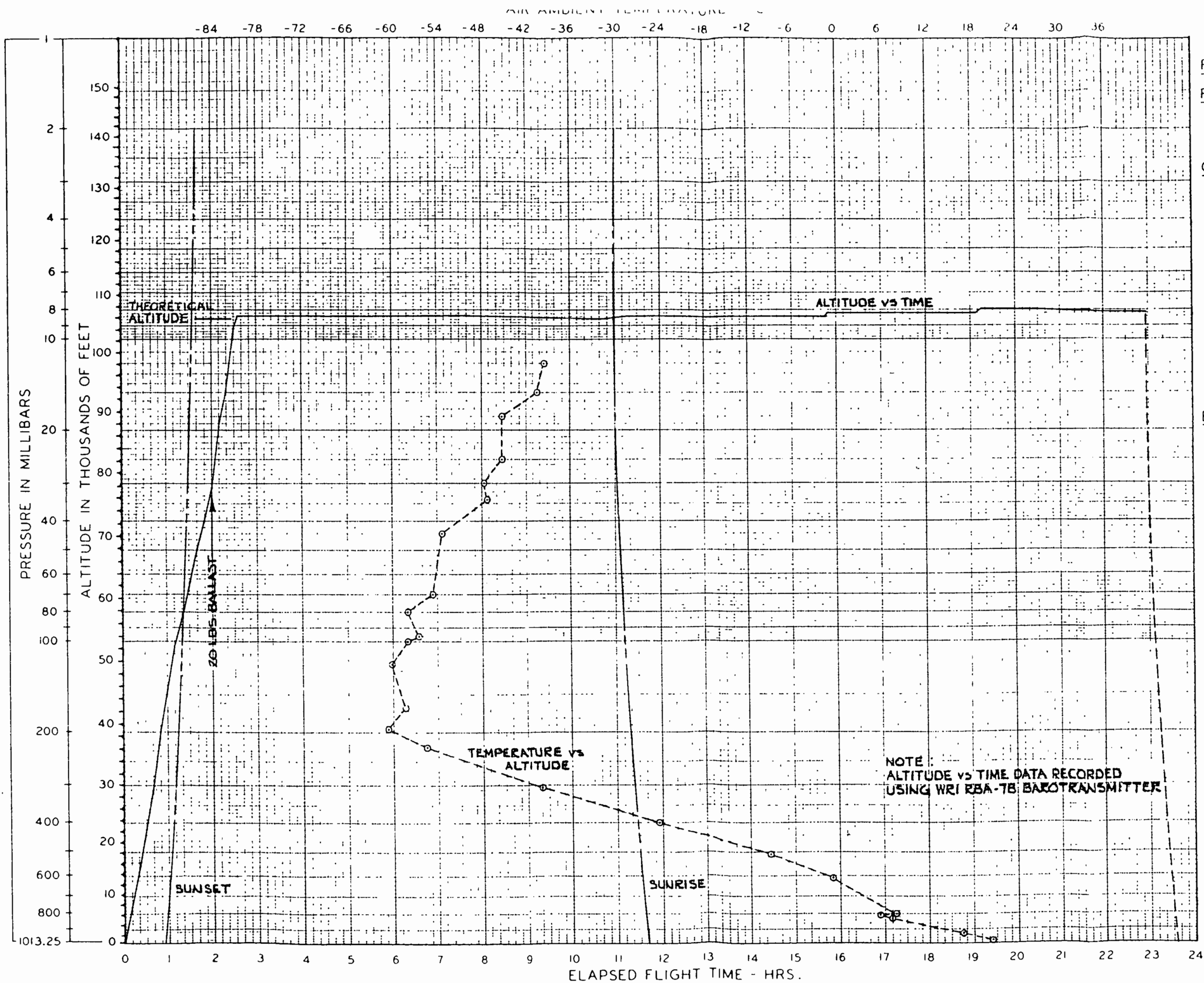
### 3. Recovery

Termination and balloon destruction were witnessed both by plane and ground tracking vehicle. Severe oscillation of the parachute and payload was observed at high altitude. The descent was visual to both tracking crews from altitude to impact. The load landed on a dirt road in a heavily wooded area 1/2 mile east of Cable, Wisconsin. The ground crew was on site within 5 minutes after impact. The crash pad was completely crushed and the instrument framework was somewhat bent but none of the instruments displayed any visual damage. Dr. Earl's power supply was returned to WRI plant at 2100 CDT, 7 September by plane and the remainder of the scientific equipment was returned 0100 CDT, 8 September by truck.

### 4. Balloon Performance

The balloon ascent rate was 650 fpm from launch to 78,000. At this point 20 pounds of ballast was dropped and the ascent rate increased to 770 fpm. Maximum altitude attained was 107,600 feet, which is 1700 feet above theoretical ceiling. During the 20 hour and 25 minutes at ceiling the altitude was  $106,700 \pm 900$  feet. This level altitude was maintained without the aid of ballast. The remaining 100 pounds of ballast were dropped just prior to termination.





FLIGHT NO 1058 W  
FOR UNIVERSITY OF MARYLAND  
DR. JAMES EARL

#### GENERAL INFORMATION:

DATE - 7 SEPT 1966  
LAUNCH LOCATION -  
FLEMING FIELD,  
ST. PAUL, MINN.  
LAUNCH TIME - 0002 Z  
REACH FLOAT - 0235 Z  
TERMINATION TIME - 2300 Z  
IMPACT TIME - 2335 Z  
IMPACT LOCATION - 1/2 MILE EAST  
OF CABLE, WIS.

#### BALLOON DATA:

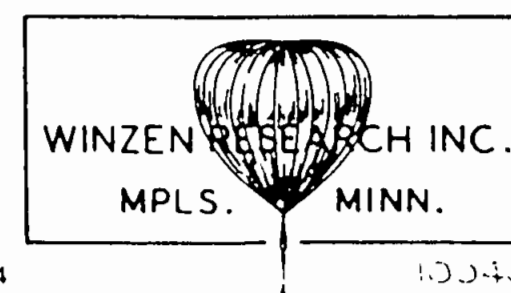
MODEL NO SF-123.6-050-NS-01  
SERIAL NO - 06  
VOLUME - 749,000 CU. FT.  
MATERIAL - 0.5 MIL STRATOFILM  
LOAD TAPES - 100 LB. STRATOTAPE  
WEIGHT - 162 LBS.

#### FLIGHT DATA:

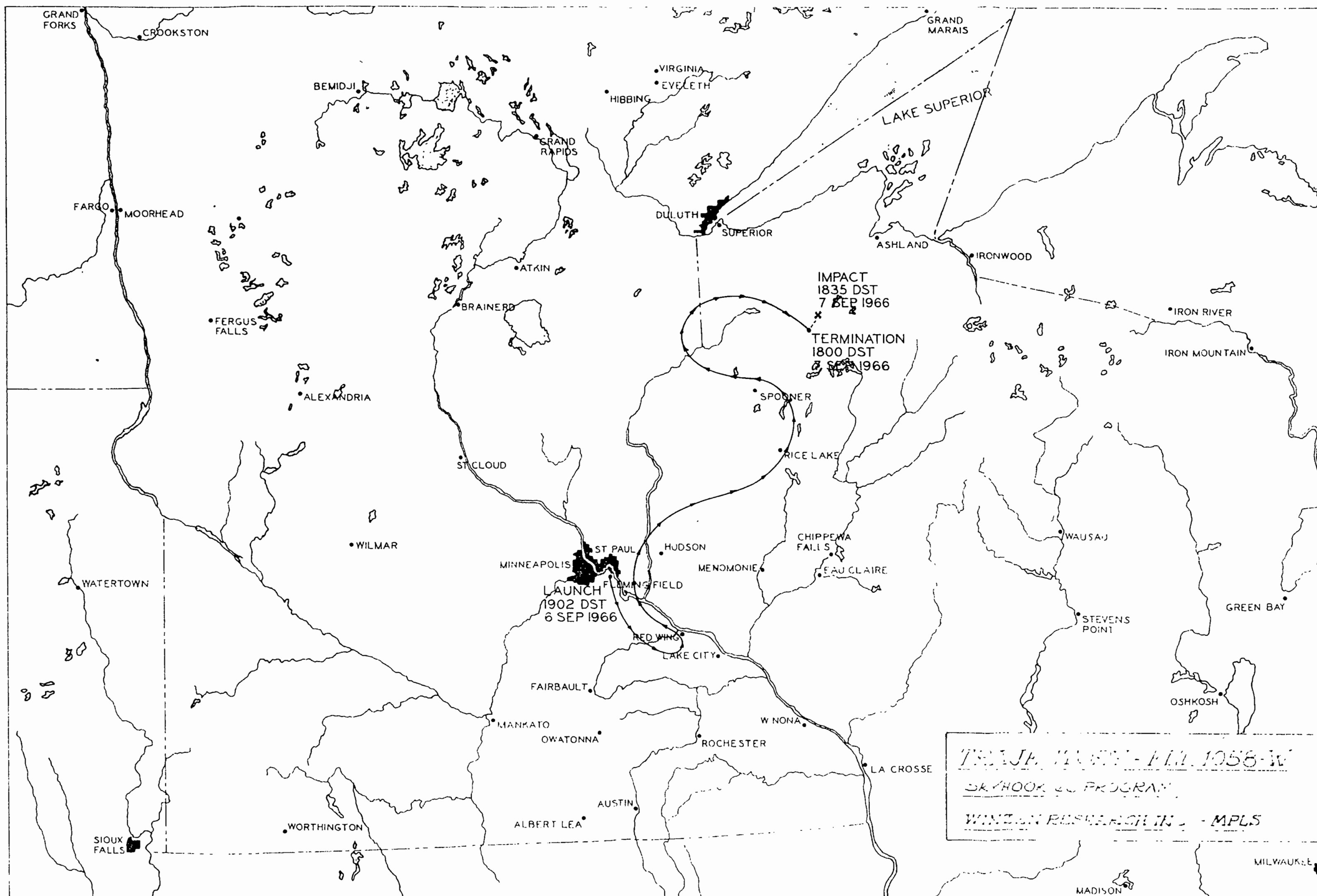
PAYLOAD WT. - 250 LBS.  
GROSS LOAD - 532 LBS.  
FREE LIFT - 80 LBS. (15%)  
BALLAST WT - 120 LBS.

#### REMARKS:

LEVEL FLIGHT MAINTAINED  
WITHOUT USE OF BALLAST.  
ALL INSTRUMENTS FUNCTIONED  
SATISFACTORILY. SUCCESSFUL  
FLIGHT.



100404

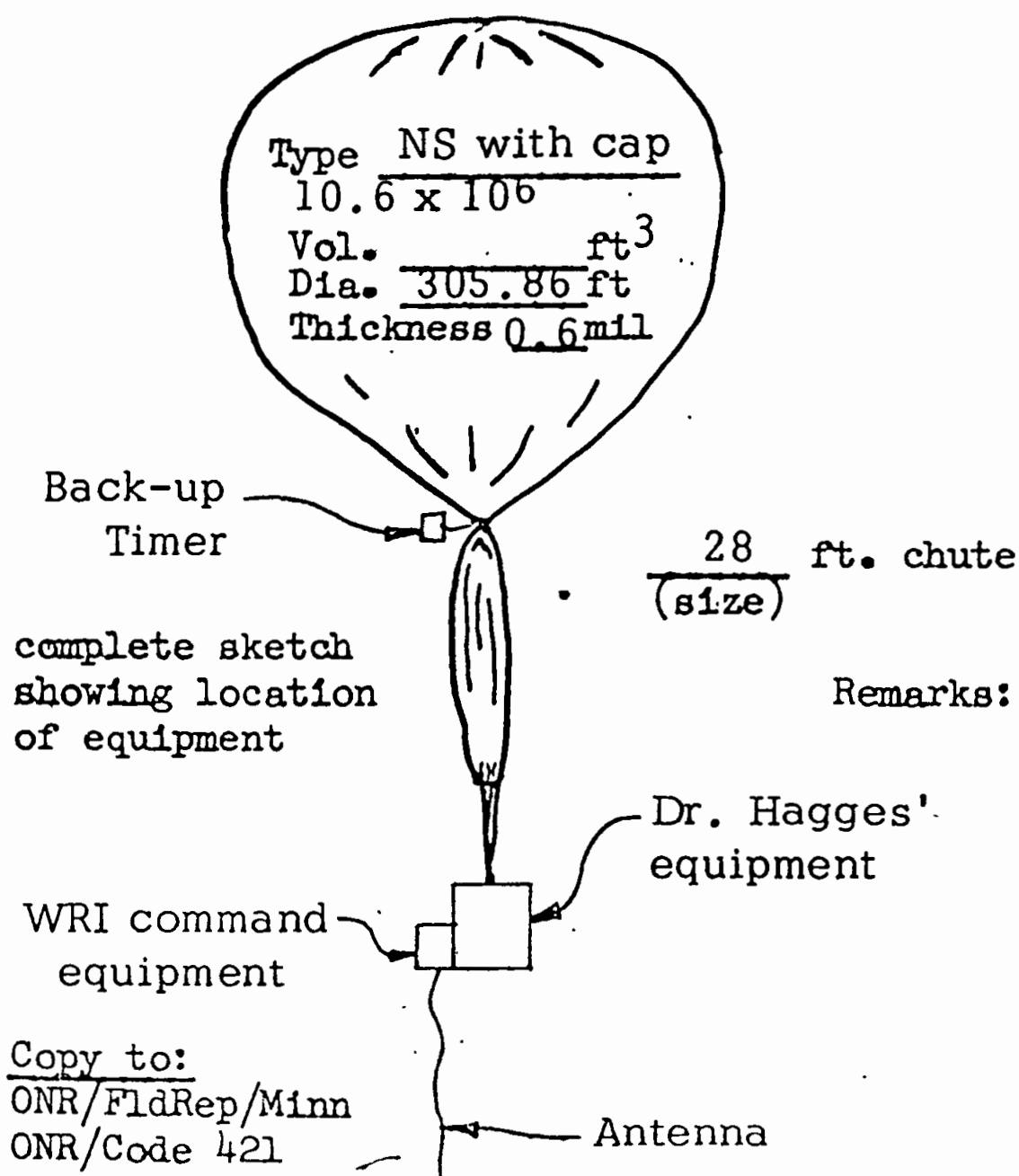


SKYHOOK BALLOON FLIGHT INFORMATION  
NAVEXOS 3900/2 (Rev.11-63)

1. Company Winzen Research Inc. Flight number 1046 W  
2. Scientist Dr. Donald Hagge Organization NASA  
Goddard Space Flight Center  
3. Launch: Site Bemidji, Minnesota Date/time 14 Sept. 1966 0739Z  
Technique Anchor Line Director Soren Swenson  
4. Weather: Clear 55° F 0 to 3 mph Tropopause: Height 55,900 ft. Temp -54.7° C  
( Sky - Temp - Wind - Press )  
5. Balloon Ceiling: Theoretical 1.90 Mbs 141,500 Ft. Actual: 141,500 Ft. 1.90 Mbs  
How altitude determined WRI RBA-7B Barotransmitter  
6. Ascent: Surface to tropopause 545 fpm. Tropopause to ceiling 606 fpm.  
7. Flight duration: Total 13 hrs. 31 min. At ceiling 8 hrs. 50 min.  
8. Termination: Time 20:30 Z Altitude 140,300 ft. Cause Radio command  
9. Balloon destruction - confirmed Visual - float plane  
(visual - unknown - etc.)  
approx.  
10. Impact: Date/time 14 Sept. 66 21:10 Z Location 15 mi. East Outer Island in  
Lake Superior  
11. Frequency used: (Kcs, Mcs) (purpose) (Total Time) Standby/  
1724 Kc Alt. data & ADF 13:31/13:31 radiating  
138.540 Mc Command 13:31/0:12  
138.840 Mc Voice 13:31/0:30  
12. Balloon: Code number SF 305.86-060-NSC-01 Serial number 53

WEIGHT

Balloon - - - - -	1111 $\frac{1}{2}$
FAA Termination Timer	3
Parachute - - - - -	12
Instrumentation - - -	35
Ballast - - - - -	375
Scientific package- -	265
Other - - - - -	6 Camera
Gross Weight- - - - -	1807
Free Lift - - - - -	225
Gross Inflation - - -	2032
Helium used - - - - -	30,800 cuft



Rate of ascent slow, 250 lbs. ballast dropped to achieve desired altitude. Flight at ceiling varied from 140,000 to 141,500 for 8 hrs. and 50 min. Payload landed in Lake Superior and was recovered by U.S. Coast Guard

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ONR/Code 421

## FLIGHT 1046-W

### 1. Launch Operations

The payload consisted of five separate units (WRI command instruments, ballast hopper and three packages which belonged to Dr. Hagge) mounted on or attached to an aluminum framework. The load was launched with no problems.

### 2. Tracking

Altitude data and ADF transmissions were excellent throughout the flight. Visual contact was maintained with the balloon during the day from Bemidji. The tracking plane left Bemidji at approximately 1330 CDT and was in the vicinity of the balloon at 1430 which by this time was over Lake Superior. The airplane landed at Ashland, Wisconsin and remained there until 1500 CDT at which time information was received from the base station at Bemidji that termination would take place at 1530 CDT. One man from airplane crew remained at Ashland to man the airport radio and the remainder of the crew took off and proceeded to the termination area. The man at Ashland telephoned the U.S. Coast Guard at Bayfield, Wisconsin and informed them of the anticipated impact area. They dispatched a boat to pick up the load.

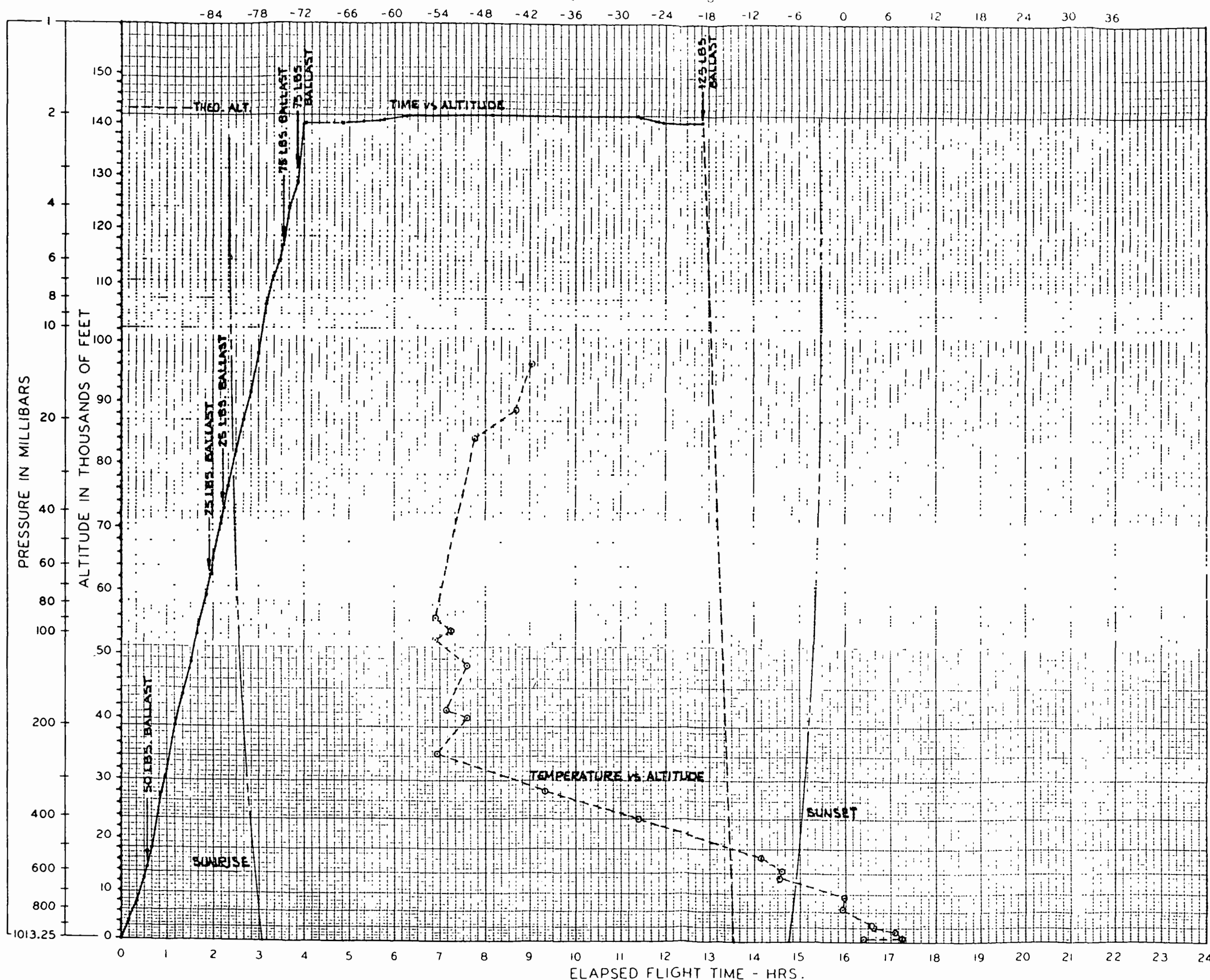
### 3. Recovery

Termination and balloon destruction were witnessed by tracking plane, the member of the crew stationed at Ashland and the Coast Guard. The airplane circled the load until the Coast Guard boat arrived. They picked up the load 15 miles east of Outer Island and returned it to Bayfield. That evening a ground vehicle that had been dispatched from Bemidji picked up the man at Ashland and they proceeded to Bayfield and secured the load from the Coast Guard. The following afternoon the payload was returned to Dr. Hagge by truck.

### 4. Balloon Performance

Since the initial rate of rise was only 430 fpm to 14,600 feet, 50 pounds of ballast was dropped. The rate then increased to 610 fpm and remained approximately constant for the remainder of the ascent although additional ballast drops of 25, 25, 75 and 75 pounds were required. The balloon reached a ceiling of 140,000 feet and about two hours later climbed to 141,000 - 141,500 feet. It remained within these limits until one and one half hours before termination when it dropped to 140,300 feet. Theoretical ceiling for the balloon and payload was 141,500 feet. The remaining ballast on board (125 lbs.) was dropped just prior to termination.





FLIGHT NO 1046 W

FOR: DR. HAGGE -  
GSFC, NASA

GENERAL INFORMATION:

DATE - 14 SEPTEMBER 1966

LAUNCH LOCATION -  
BEMIDJI, MINN. AIRPORT

LAUNCH TIME - 0739 Z

REACH FLOAT - 1140 Z

TERMINATION TIME - 2030 Z

IMPACT TIME - 2110 Z APPROX.

IMPACT LOCATION -  
15 MI. EAST OF OUTER ISLAND  
IN LAKE SUPERIOR

BALLOON DATA:

MODEL NO. SF-305.86-060-NSC-C

SERIAL NO - 53

VOLUME - 10.6 MILLION CU. FT.

MATERIAL - 0.6 MIL STRATOFILM

LOAD TAPES - 100 LB. STRATOTAPI

WEIGHT - 1111 LBS.

FLIGHT DATA:

PAYLOAD WT - 321 LBS.

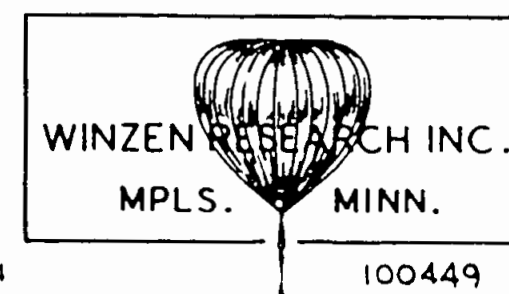
GROSS LOAD - 1807 LBS.

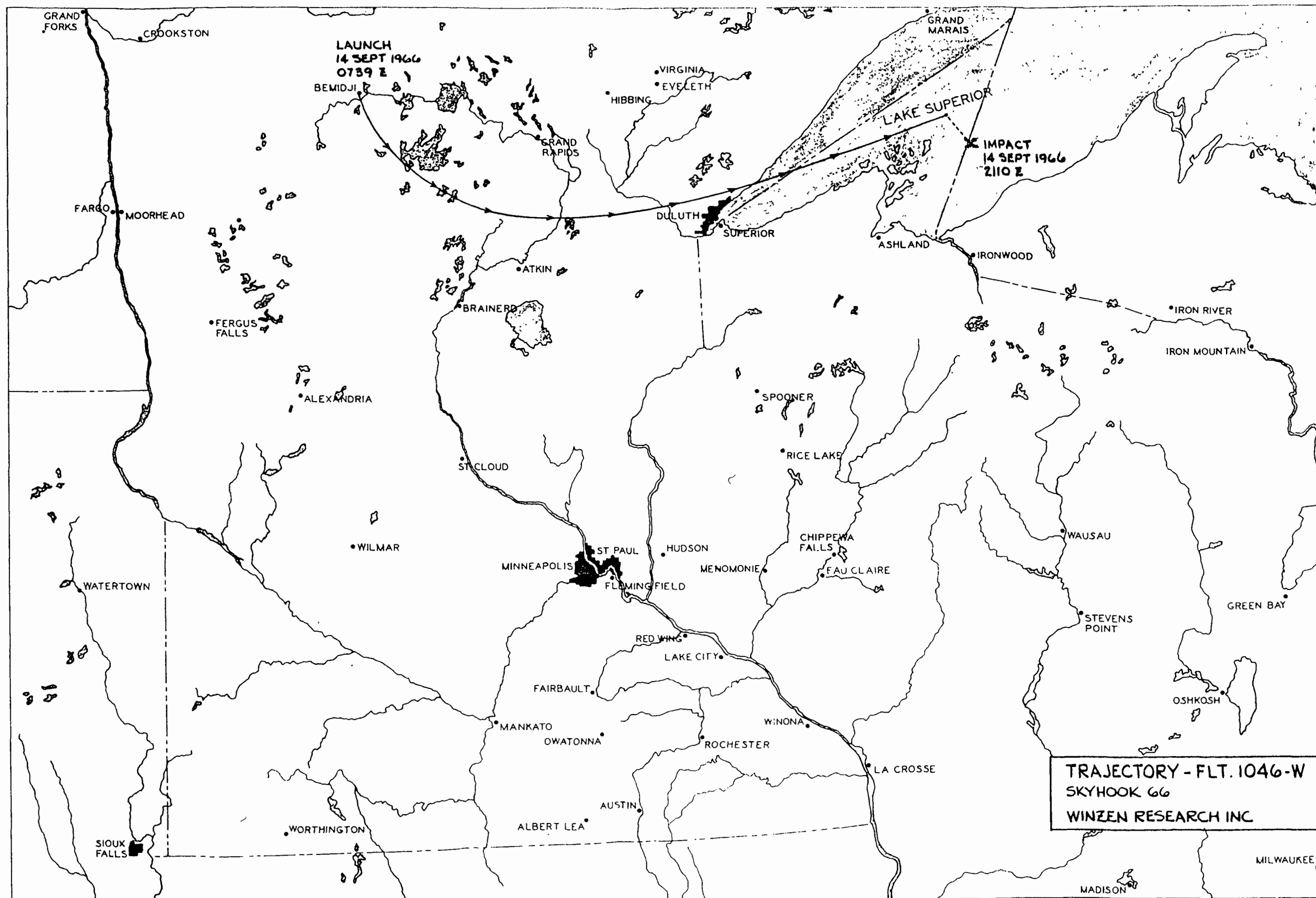
FREE LIFT - 225 LBS.

BALLAST WT - 375 LBS.

REMARKS:

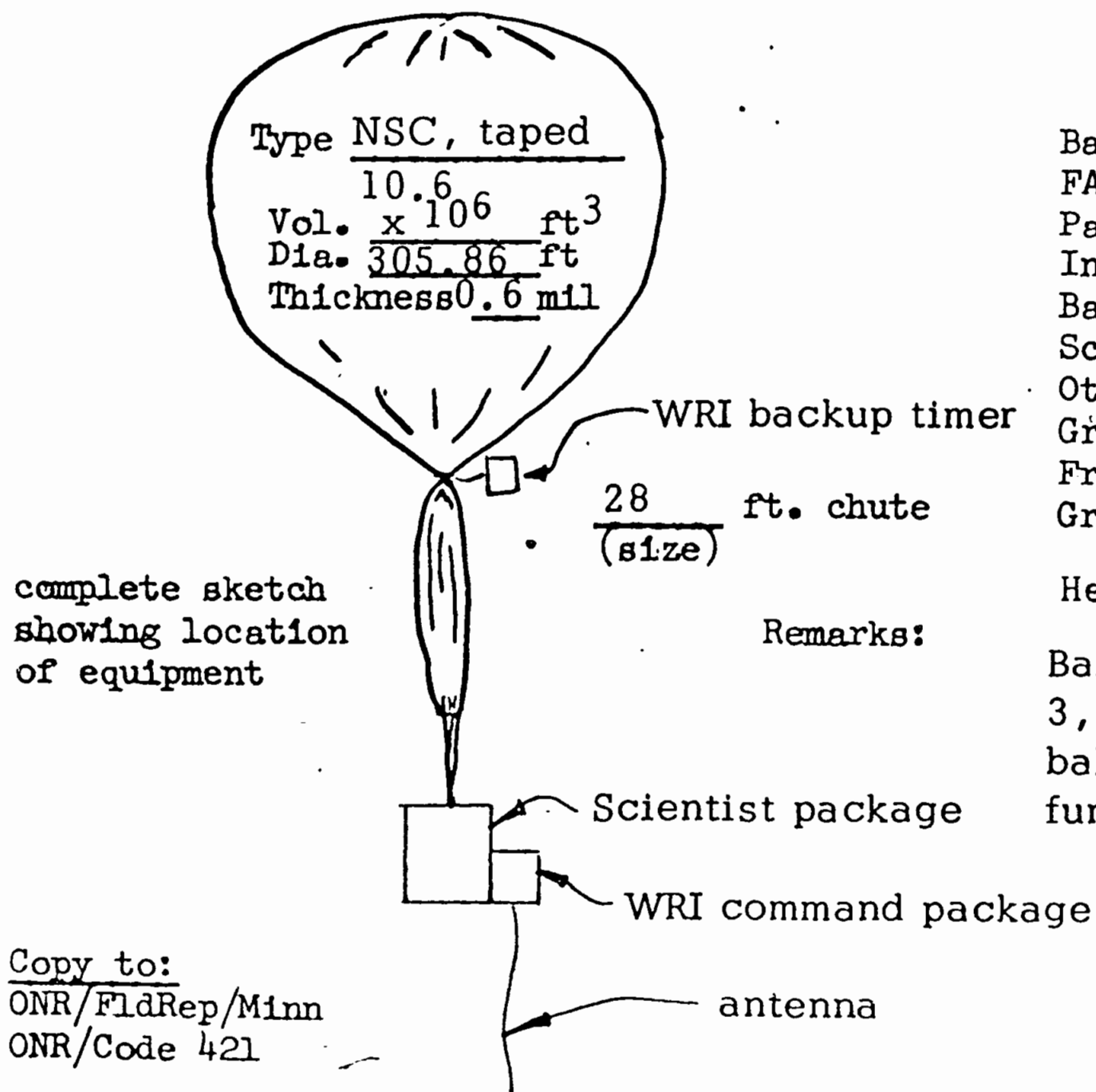
RATE OF ASCENT SLOW.  
INSTRUMENTS PERFORMED EXCEL-  
LENTLY. FLT AT CEILING VARIED  
1500 FT OVER 8 HRS. 50 MIN.  
PAYLOAD LANDED IN LAKE SUPERIOR  
RECOVERED BY U.S. COAST GUARD.





SKYHOOK BALLOON FLIGHT INFORMATION  
 IAVEXOS 3900/2 (Rev.11-63)

1. Company Winzen Research Inc. Flight number 1047 - W  
 2. Scientist Dr. Donald Hagge Organization NASA, Goddard Space Flt. Ctr.  
 3. Launch: Site Airport, Bemidji, Minnesota Date/time 14 Sept. 1966 1422Z  
 Technique Anchor Line Director Soren Swenson  
 4. Weather: Clear 65°F 0-3 mph No. Tropopause: Height 55,900 ft Temp 54.7°C  
 ( Sky - Temp - Wind - Press )  
 5. Balloon Ceiling: Theoretical 2.12 Mbs 139,200 Ft. Actual: 143,000 Ft. 1.79 Mbs  
 How altitude determined WRI Barotransmitter RBA-7B  
 6. Ascent: Surface to tropopause 933 fpm. Tropopause to ceiling 1270 fpm.  
 7. Flight duration: Total 10 hrs. 8 min. At ceiling 7 hrs. 13 min.  
 8. Termination: Time 2345 Z Altitude 142,400 ft. Cause Radio Command  
 9. Balloon destruction - confirmed Visual  
 (visual - unknown - etc.)  
 10. Impact: Date/time 15 Sept. 1966 0030 Z Location 10 mi. N.E. Aitkin, Minnesota  
 1. Frequency used: (Kcs, Mcs) (purpose) (Total Time) Standby/  
 1710 Kc Alt. trans. & ADF 10:08/10:08  
 138.540 Mc Command 10:08/00:10  
 138.840 Mc Voice 10:08/00:30  
 2. Balloon: Code number SF 035.86-060-NSC-01 Serial number 101



	WEIGHT
Balloon - - - - -	1097 #
FAA Termination Timer	2
Parachute - - - - -	12
Instrumentation - - -	35
Ballast - - - - -	125
Scientific package - -	229
Other - - - - -	8
Gross Weight - - - - -	1508
Free Lift - - - - -	237 (15%)
Gross Inflation - - -	1745
Helium used - - - - -	26,490 cuft.

Balloon exceeded theoretical altitude by 3,800 feet. Balloon flown without drive-up ballast due to helium shortage. All systems functioned properly. Successful flight.

Copy to:  
 ONR/FldRep/Minn  
 ONR/Code 421

## FLIGHT 1047-W

### 1. Launch Operations

Helium supply for this launch was minimal and the 250 pounds of ballast designated for drive-up had to be dumped before launch to obtain needed lift. Launch was smooth and without incident.

### 2. Tracking

Visual tracking was provided by the WRI aircraft. Altitude data was recorded at the WRI plant. Payload and balloon were tracked to impact.

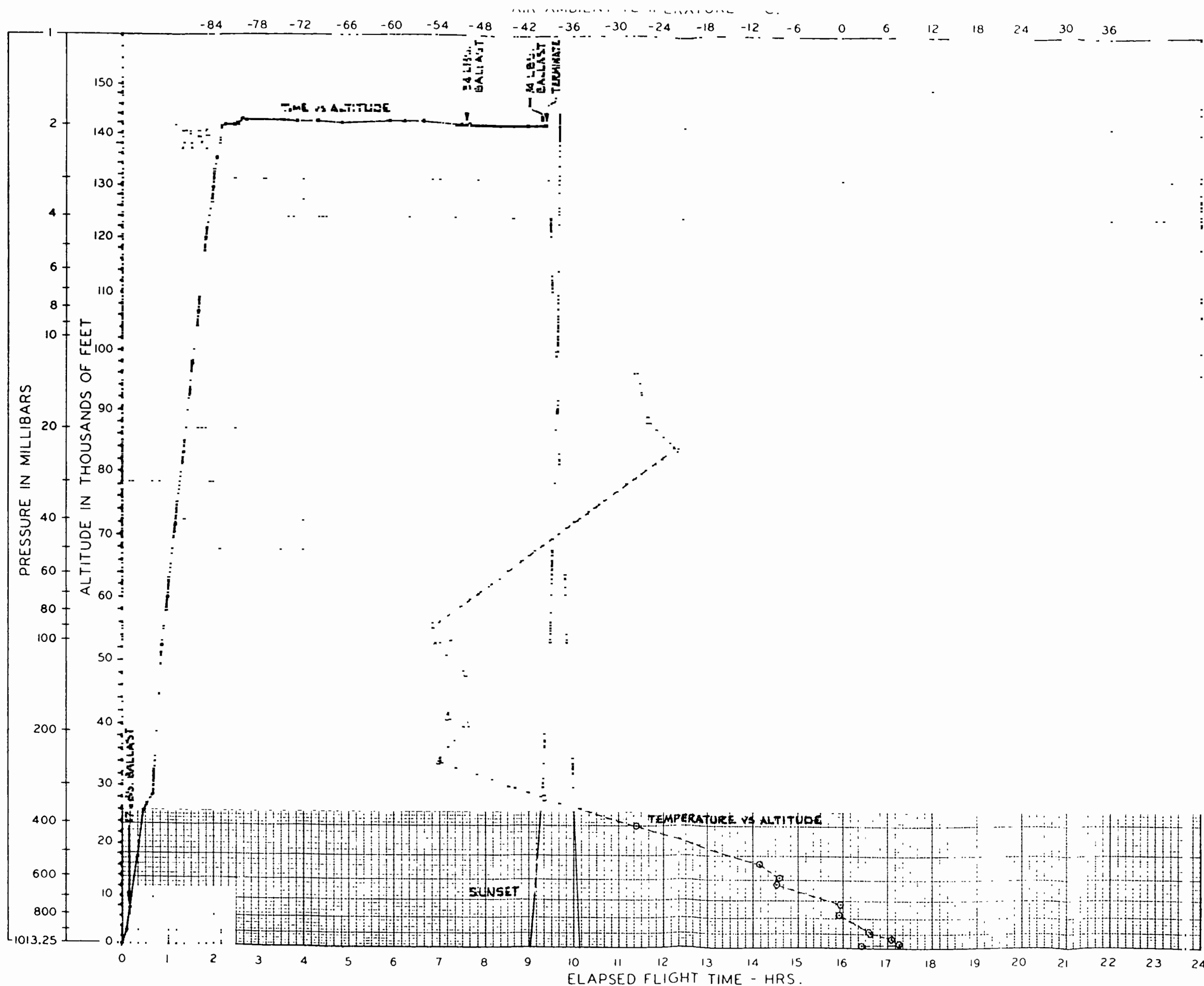
### 3. Recovery

Cut down on this flight was delayed until flight 1048-W which was also up, was spotted down. Recovery was delayed until the following day (CDT) because of late hour of impact and impact location. All instruments recovered intact and in good condition although the timer was missing. Second search of impact area failed to locate lost timer.

### 4. Balloon Performance

Balloon was flown without drive-up ballast as a helium shortage required no more weight than necessary be flown with payload. RBA-7B transmitter data shows balloon floated 3,800 feet higher than theoretical float altitude.





FLIGHT NO 1047 W

FOR: DR. HAGGE -  
GSFC, NASA

GENERAL INFORMATION:

DATE - 14 SEPT 1966

LAUNCH LOCATION -  
BEMIDJI, MINN. AIRPORT

LAUNCH TIME - 1422 Z

REACH FLOAT - 1632 Z

TERMINATION TIME - 2345 Z

IMPACT TIME - 0030 Z - 15 SEPT 1966

IMPACT LOCATION -  
10 MI. N E. OF AITKIN, MINN.

FLOAT DURATION - 7 HRS. 13 MIN.

BALLOON DATA:

MODEL NO SF-305.86-060-N5C-01

SERIAL NO - 101

VOLUME - 10.6 MILLION CU. FT.

MATERIAL - 0.6 MIL STRATOFILM

LOAD TAPES - 100 LB. STRATOTAPE

WEIGHT - 1097 LBS.

FLIGHT DATA:

PAYLOAD WT - 286 LBS.

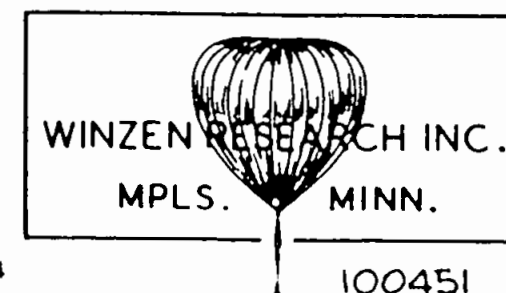
GROSS LOAD - 1508 LBS.

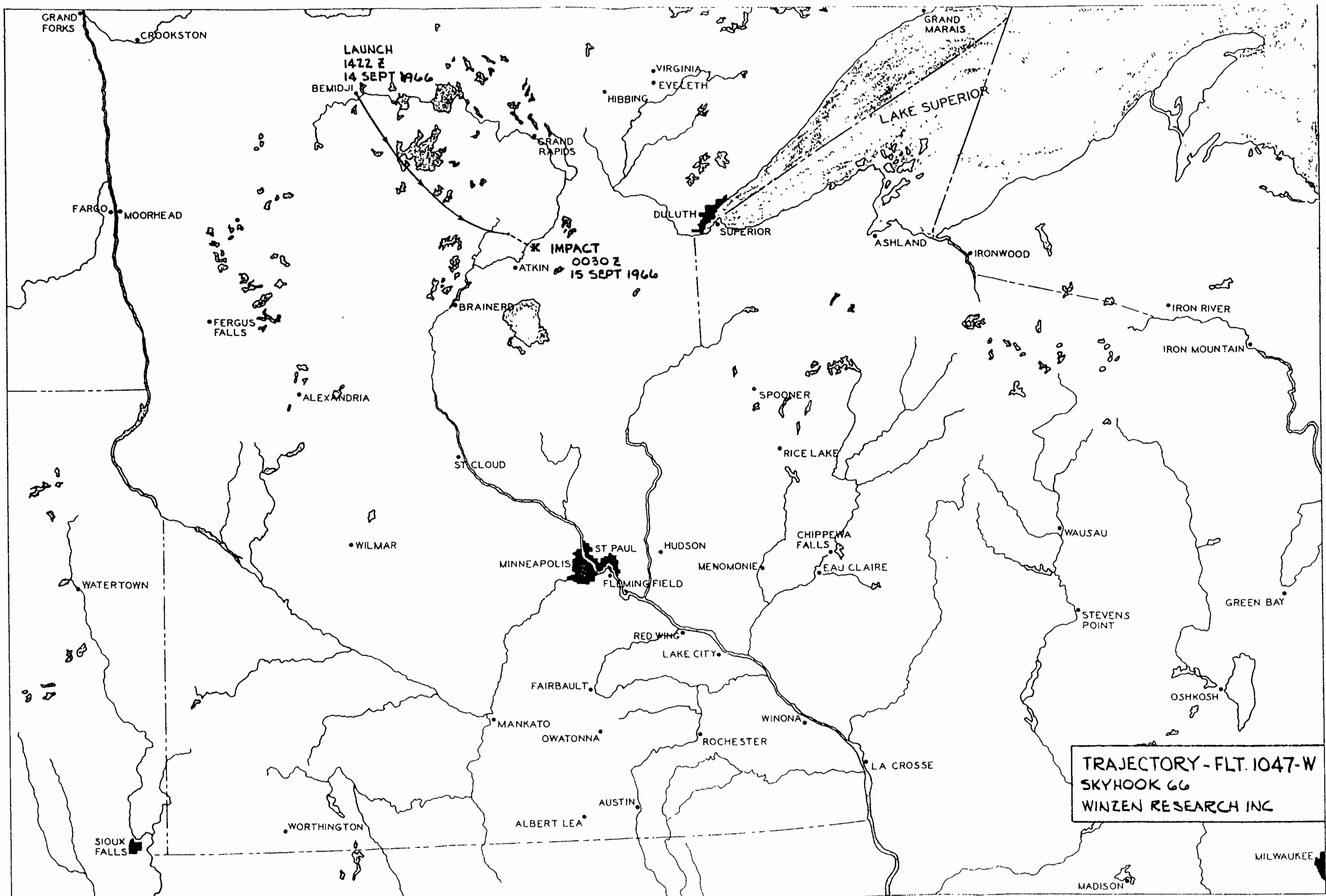
FREE LIFT - 237 LBS. (15%)

BALLAST WT. - 125 LBS.

REMARKS:

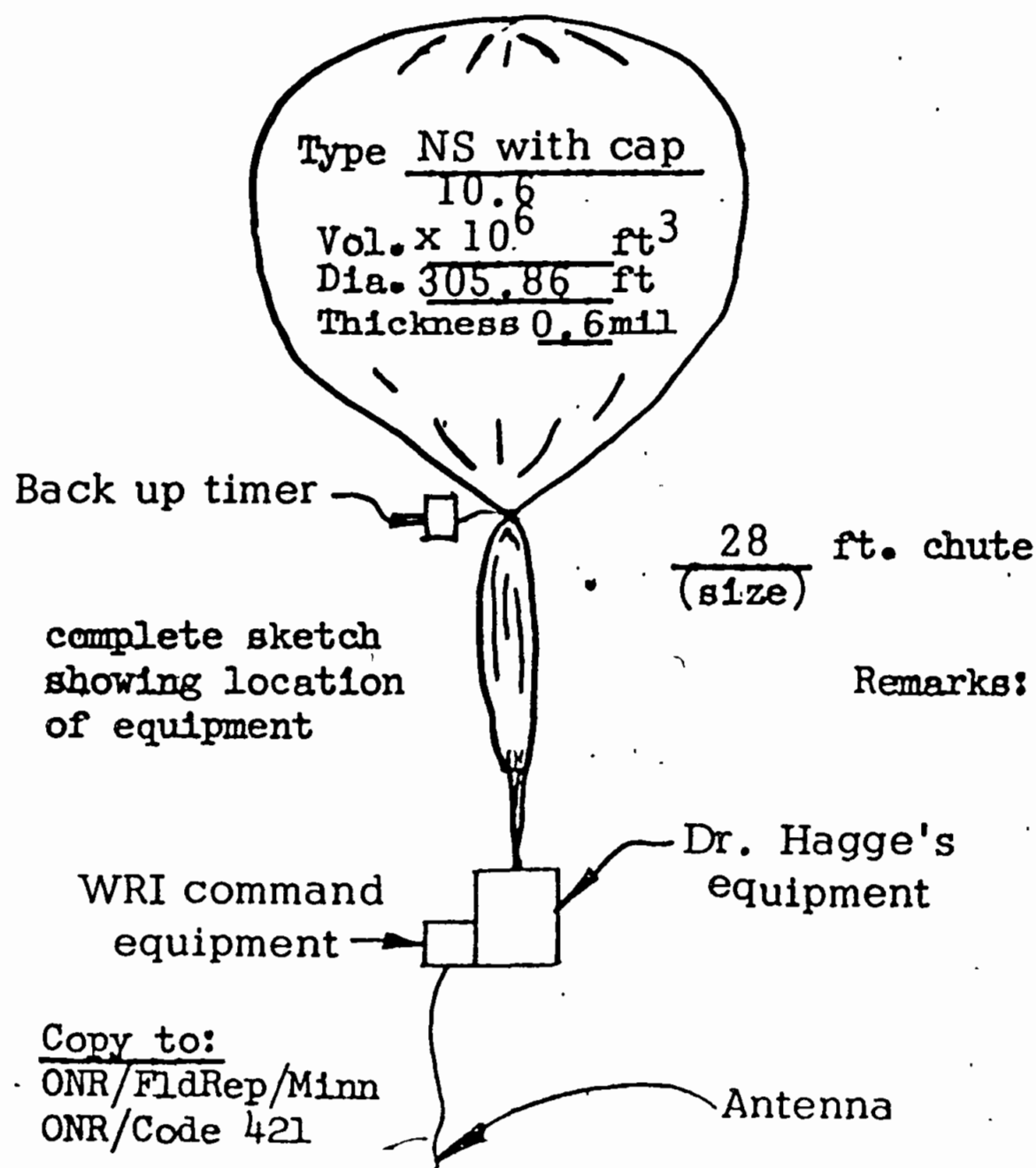
BALLOON EXCEEDED THEO. ALT.  
BY 3,800 FT. ALL SYSTEMS  
FUNCTIONED PROPERLY.  
PAYLOAD RECOVERED & RETURNED  
IN GOOD CONDITION.





SKYHOOK BALLOON FLIGHT INFORMATION  
NAVEXOS 3900/2 (Rev.11-63)

1. Company Winzen Research Inc. Flight number 1049-W
2. Scientist Dr. Donald Hagge Organization NASA Goddard Space Flt. Ctr.
3. Launch: Site Bemidji, Minnesota Date/time 19 Sept. 1966 0950Z  
Technique Anchor Line Director Soren Swenson
4. Weather: Clear 42° F 4 mph Tropopause: Height 53,200 ft. Temp -58.2°C  
( Sky - Temp - Wind - Press )
5. Balloon Ceiling: Theoretical 2.60 Mbs 133,700 Ft. Actual: 128,400 Ft. 3.23 Mbs  
How altitude determined WRI RBA-7B Barotransmitter
6. Ascent: Surface to tropopause 794 fpm. Tropopause to ceiling 587 fpm.
7. Flight duration: Total 3 hrs. 55 min. At ceiling 0 hrs. 0 min.
8. Termination: Time 13:06 Z Altitude 128,000 ft. Cause Command
9. Balloon destruction - confirmed Visual by float plane pilot  
(visual - unknown - etc.)
10. Impact: Date/time 19 Sept. 1966 1345 Z Location 2 mi. N. Huntersville, Minn.
11. Frequency used: (Kcs, Mcs) (purpose) (Total Time) Standby/  
1724 Kc Alt. data & ADF 3:55/3:55 Radiating  
138.540 Mc Command 3:55/0:10  
138.840 Mc Voice 3:55/0:02
12. Balloon: Code number SF 305.86-060-NSC-0 Serial number 102



	WEIGHT
Balloon - - - - -	1094 #
FAA Termination Timer	3
Parachute - - - - -	12
Instrumentation - - -	35
Ballast - - - - -	405
Scientific package- -	281
Other - - - - -	6 camera
Gross Weight- - - - -	1836
Free Lift - - - - -	284.
Gross Inflation - - -	2120
Helium used - - - - -	32,200 cuft

Good launch. Sufficient rate of rise maintained without expenditure of drive up ballast. Balloon terminated before reaching float from unknown cause.

## FLIGHT 1049 W

### 1. Launch Operations

A smooth launch was effected one hour and twelve minutes after start of layout. The antenna deployed and altitude data was transmitted clearly. No problems at launch. An up-camera was used on this flight.

### 2. Tracking

By the time the balloon had drifted out of line of sight of the crew stationed at Bemidji the tracking pilot stationed at Park Rapids, Minnesota had obtained visual contact with the balloon. He maintained contact until the premature termination. Upon termination he took off in the tracking aircraft and flew to the area of the descending parachute and load and remained with it until after impact.

### 3. Recovery

Immediately after termination a ground vehicle was dispatched from Bemidji to the impact site. The vehicle proceeded to the general area and was guided by the aircraft tracking pilot to the payload. The ground tracking crew examined the load and determined that the back-up timer was still fastened to the top of the parachute and its squibs had not been fired. The load was hauled out of the woods and returned to Bemidji. The balloon was checked by the flight crew about one week later to determine if the eyenut had come loose, base fitting had pulled out, balloon had failed or for any other evidence which would have caused the premature termination. None could be found, it appeared as if a normal termination had occurred. Examination of the up-camera pictures also showed a normal termination. The camera was triggered "on" by a time delay switch actuated through the command termination circuit.

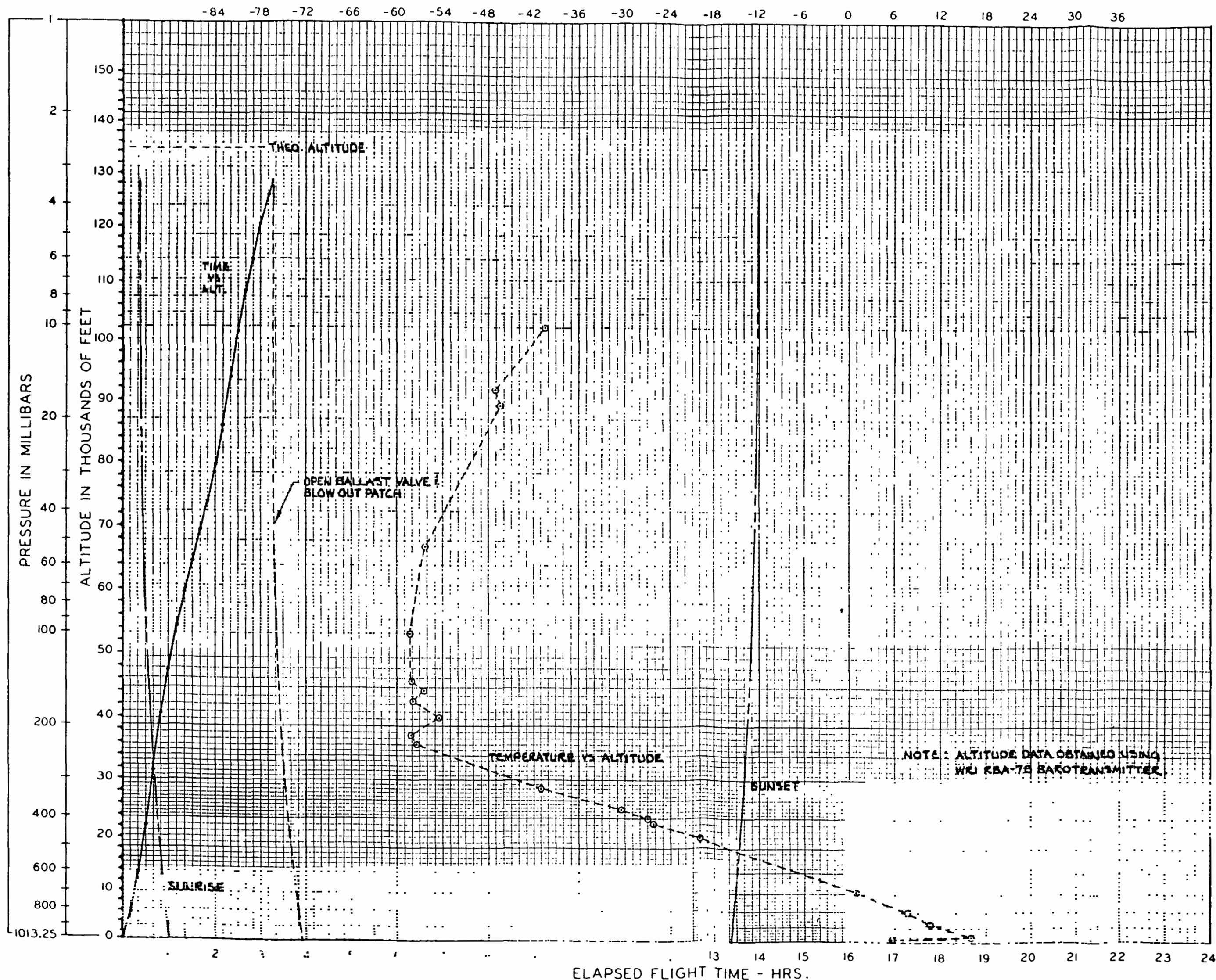
### 4. Balloon Performance

The balloon was performing satisfactorily prior to its termination. The ascent rate to the tropopause was 794 fpm and from there to maximum altitude it was 587 fpm. No ballast had been used prior to termination.

### 5. Conclusions and Action Taken

All of the data available points to a termination caused by a spurious command signal to the radio control system. It was subsequently determined that a local company, Werner Trucking concern was dispatching their vehicles using the ONR assigned command frequency for WRI flights for which they had no authorization. Additional gating will be provided in the command system for future operations.





FLIGHT NO. 1049W

FOR: DR. HAGGE -  
GSFC, NASA

#### GENERAL INFORMATION:

DATE - 19 SEPT 1966

LAUNCH LOCATION -  
BEMIDJI, MINN. AIRPORT

LAUNCH TIME - 0950 Z

REACH FLOAT - SEE REMARKS

TERMINATION TIME - 1305 Z

IMPACT TIME - 1345 Z

IMPACT LOCATION -  
2 MI. NORTH OF HUNTERSVILLE,  
MINN.

#### BALLOON DATA:

MODEL NO. SF-305.86-060-NBC-01

SERIAL NO - 102

VOLUME - 10.6 MILLION CU. FT.

MATERIAL - 0.6 MIL STRATOFILM

LOAD TAPES - 100 LB. STRATOTAPE

WEIGHT - 1094 LBS.

#### FLIGHT DATA:

PAYLOAD WT. - 337 LBS.

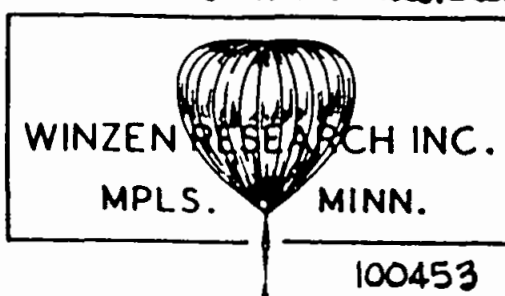
GROSS LOAD - 1843 LBS.

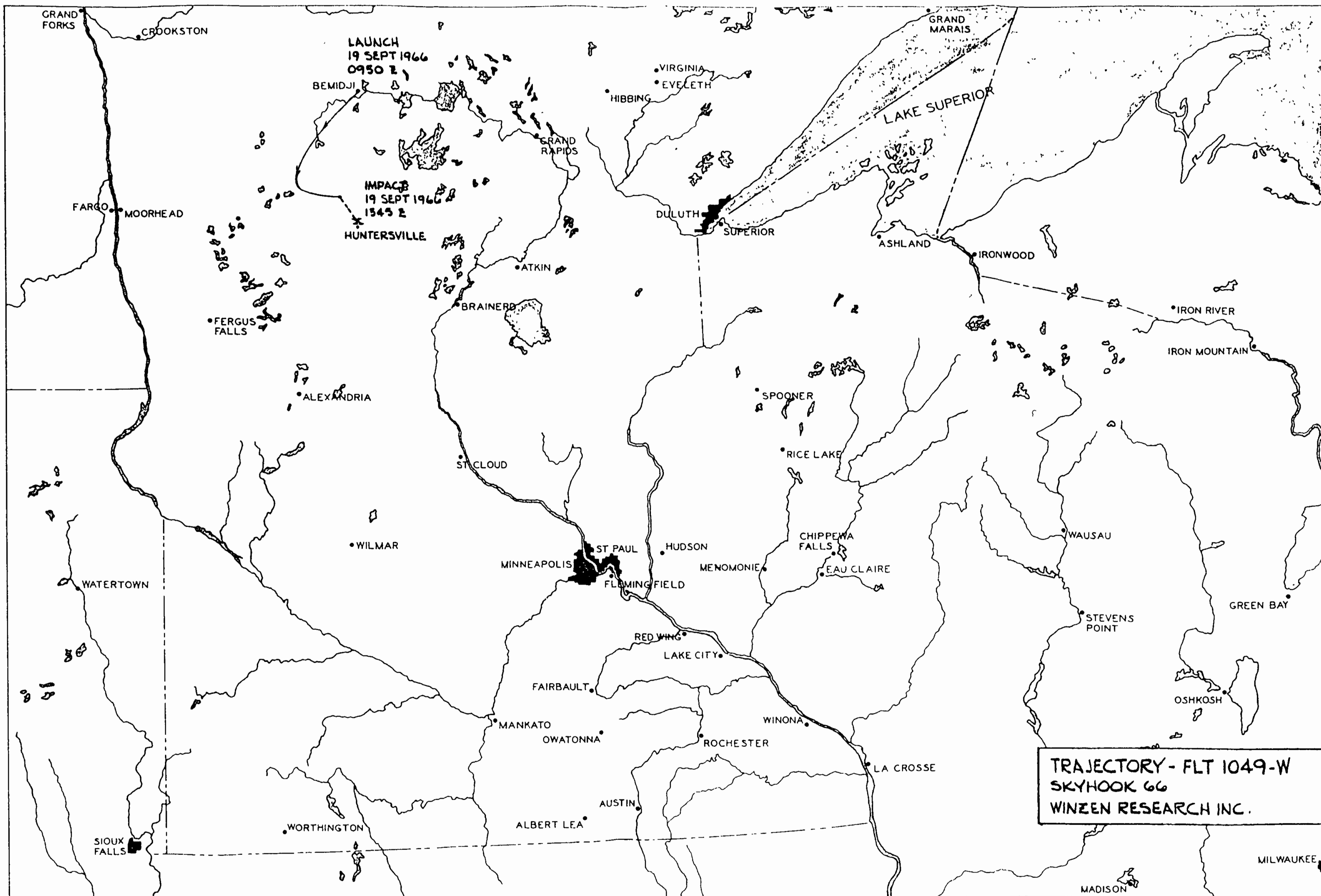
FREE LIFT - 284 LBS.

BALLAST WT. - 405 LBS.

#### REMARKS:

FLT. TERMINATED DURING ASCENT AT  
128,000 FT. BY UNKNOWN CAUSE.  
PROBABLE CAUSE OF PREMATURE TERM.  
IS AN UNAUTHORIZED SIGNAL. EQUIP-  
MENT HAS BEEN MODIFIED TO PREVENT  
REOCURENCE. PAYLOAD RECOVERED.





SKYHOOK BALLOON FLIGHT INFORMATION  
NAVEXOS 3900/2 (Rev.11-63)

1. Company Winzen Research Inc. Flight number 1055 W

2. Scientist Dr. Donald Hagge Organization NASA Goddard Space Flt. Ctr.

3. Launch: Site Bemidji, Minnesota Airport Date/time 23 Sept. 1966 1210Z

Technique Anchor Line Director Soren Swenson

4. Weather: Clear 39° F N. 9 mph Tropopause: Height 47,300 ft. Temp -58.4° C  
( Sky - Temp - Wind - Press )

5. Balloon Ceiling: Theoretical 4.12 Mbs 122,600 Ft. Actual: 124,300 Ft. 3.83 Mbs  
How altitude determined WRI RBA-7B Barotransmitter

6. Ascent: Surface to tropopause 675 fpm. Tropopause to ceiling 860 fpm.

7. Flight duration: Total 6 hrs. 10 min. At ceiling 2 hrs. 39 min.

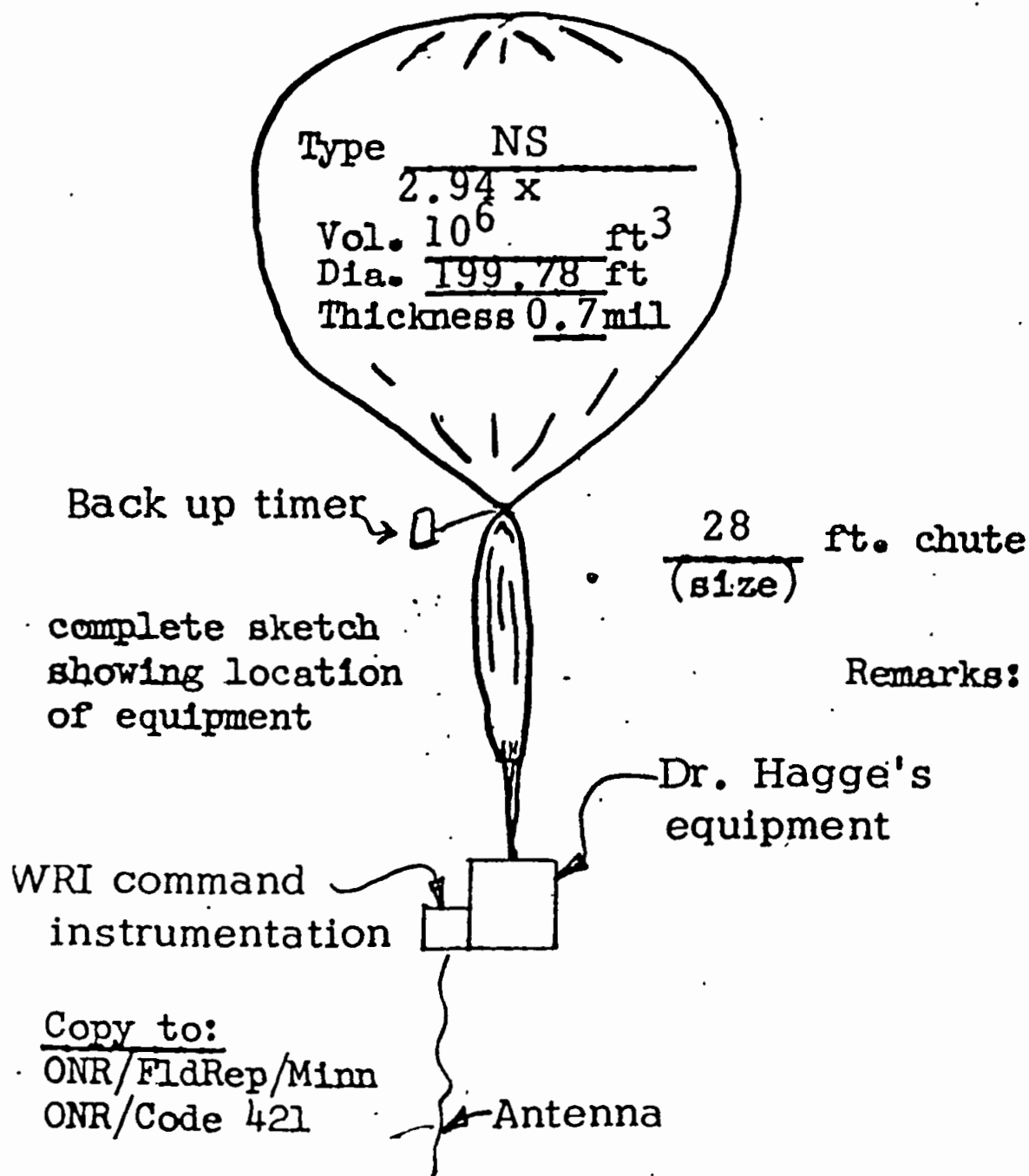
8. Termination: Time 1745 Z Altitude 124,100 ft. Cause Radio command

9. Balloon destruction - confirmed Visual by tracking aircraft  
(visual - unknown - etc.)

10. Impact: Date/time 23 Sept. 1966 1820 Z Location 10 mi. SE Drummond, Wisconsin

11. Frequency used: (Kcs, Mcs) (purpose) (Total Time) Standby/  
1710 Kc Alt. data & ADF 6:10/6:10 Radiating  
138.540 Mc Command 6:10/0:07  
138.840 Mc Voice 6:10/0:25

12. Balloon: Code number SF 199.78-070-NS-04 Serial number 265



	WEIGHT
Balloon - - - - -	466 #
FAA Termination Timer	3
Parachute - - - - -	12
Instrumentation - - -	35
Ballast - - - - -	240
Scientific package - -	285
Other - - - - -	6 camera
Gross Weight - - - - -	1047
Free Lift - - - - -	129
Gross Inflation - - -	1176
Helium used - - - - -	17,800 cuft

Good launch with satisfactory rate of ascent. Level flight 1700 ft. above theoretical altitude. Early termination as trajectory indicated balloon would fly over Lake Superior. Payload tracked to ground by plane but temporarily lost in thick wooded area. Found and recovered on 3 November 1966.

Copy to:  
ONR/FldRep/Minn  
ONR/Code 421

## FLIGHT 1055 W

### 1. Launch Operation

The balloon was launched 49 minutes after starting layout with no problems.

### 2. Tracking

The balloon floated southeast from Bemidji. About 2 hours after launch the tracking aircraft flew to Isle, Minnesota near Mille Lacs Lake, where visual contact was maintained for about two hours. During this time the balloon turned to a northeasterly course toward the Apostle Islands in Lake Superior. The tracking crew then proceeded to Duluth and continued to observe the balloon trajectory. Finally when it was definitely apparent that the balloon would pass over the Apostle Islands floating northeast and over Lake Superior, it was decided to terminate the flight. The termination was initiated from the aircraft when the balloon was about 5 miles west of Port Wing, Wisconsin. The parachute and load drifted SSE and landed in a heavily wooded area. The tracking crew were unable to locate landmarks to establish the position of the payload and consequently lost its location.

### 3. Recovery

The airplane crew landed at Glidden, Wisconsin and discussed search plans with the crew from the ground vehicle which had been dispatched from Bemidji to participate in the recovery. It was decided that the ground vehicle would proceed to the general area of search which was thought to be about 10 miles north of Clam Lake and make contact with the residents in an attempt to locate a witness to the parachute descent. At the same time the airplane would continue searching. All methods proved negative and the search was abandoned late in the day. Both search vehicles returned to Bemidji and together with the rest of the flight crew returned to Minneapolis as this had been the last flight in the series. From Minneapolis two ground searches and four airborne searches were initiated with no positive results. On approximately 1 November 1966, Winzen received word from Robert L. Kuehnast of Chippewa Falls, Wisconsin that he had found the load while hunting. On 3 November 1966 a crew from Winzen and Mr. Kuehnast returned to the impact site which was about 10 miles southeast of Drummond, Wisconsin and about 10 miles west of where previous searches had been concentrated. The load was returned to Minneapolis. The following day the scientist flight data which had been tape recorded was mailed to Dr. Hagge at Goddard. The remainder of his equipment was returned by truck about 5 days later.

### 4. Balloon Performance

The ascent rate from launch to tropopause was 675 fpm. At this time 17 pounds of ballast were dropped. An additional 34 pounds were



Flight 1055 W

dropped at 83,000 feet. The ascent rate began to decrease appreciably at 118,000 feet and ballast drops of 34, 34 and 68 pounds were required to drive the balloon to 124,300 feet, 1700 feet above theoretical altitude. The flight remained level until termination. The altitude at termination was 124,000 feet.



